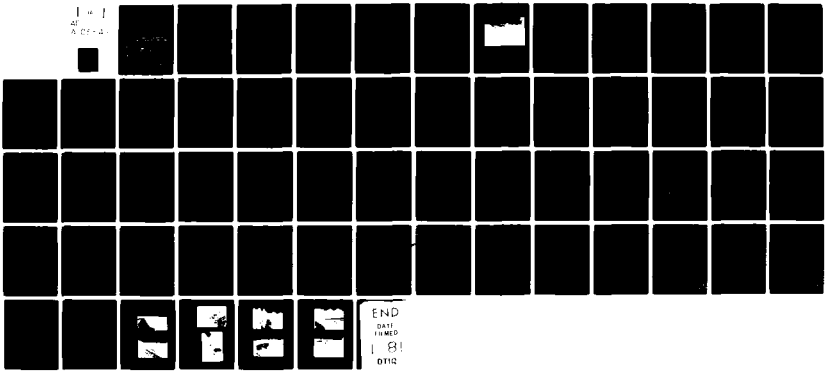
AD-A105 548 INTERNATIONAL ENGINEERING CO INC SAN FRANCISCO CA F/G 13/13
NATIONAL DAM SAFETY PROGRAM. OLD MINES TAILINGS DAM (MO 30706),~-ETC(U)
FEB 80 K B KING, S H KLINE, J H GRAY DACW43-79-C-0037

UNCLASSIFIED NL



END
DATE FILMED
8-81
DTIC

LEVEL II

MISSISSIPPI-KASKASKIA-ST. LOUIS BASIN

AD A105548

OLD MINES TAILINGS DAM
WASHINGTON COUNTY, MISSOURI
MO 30706

PHASE 1 INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

DTIC FILE COPY

United States Army
Corps of Engineers
....Serving the Army
....Serving the Nation

St. Louis District

PREPARED BY: U. S. ARMY ENGINEER DISTRICT, ST. LOUIS

FOR: STATE OF MISSOURI

FEBRUARY 1980

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE	READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER	2. GOVT ACCESSION NO. AD-A105548 / 3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Phase I Dam Inspection Report National Dam Safety Program Old Mines Tailings Dam (MO 30706) Washington County, Missouri	5. TYPE OF REPORT & PERIOD COVERED Final Report / 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) International Engineering Company, Inc.	8. CONTRACT OR GRANT NUMBER(s) DACW43-79-C-0037
9. PERFORMING ORGANIZATION NAME AND ADDRESS U.S. Army Engineer District, St. Louis Dam Inventory and Inspection Section, LMSED-PD 210 Tucker Blvd., North, St. Louis, Mo. 63101	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS 11 12
11. CONTROLLING OFFICE NAME AND ADDRESS U.S. Army Engineer District, St. Louis Dam Inventory and Inspection Section, LMSED-PD 210 Tucker Blvd., North, St. Louis, Mo. 63101	12. REPORT DATE February 1980 / 13. NUMBER OF PAGES Approximately 60
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office) National Dam Safety Program. Old Mines Tailings Dam (MO 30706), Mississippi - Kaskaskia - St. Louis Basin, Washington County, Missouri. Phase I Inspection Report.	15. SECURITY CLASS. (of this report) UNCLASSIFIED / 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE
16. DISTRIB Approved for release; distribution unlimited.	10 Kenneth B. /King Stanley H. /Kline James H. /Gray
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)	
18. SUPPLEMENTARY NOTES	
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Dam Safety, Lake, Dam Inspection, Private Dams	
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This report was prepared under the National Program of Inspection of Non-Federal Dams. This report assesses the general condition of the dam with respect to safety, based on available data and on visual inspection, to determine if the dam poses hazards to human life or property.	

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

4112587

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

OLD MINES TAILINGS DAM
WASHINGTON COUNTY, MISSOURI

MISSOURI INVENTORY NO. 30706

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

PREPARED BY
INTERNATIONAL ENGINEERING COMPANY, INC.
CONSULTING ENGINEERS
SAN FRANCISCO, CALIFORNIA

UNDER DIRECTION OF
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
FOR
GOVERNOR OF MISSOURI

FEBRUARY 1980

DEPARTMENT OF THE ARMY
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
210 NORTH 12TH STREET
ST. LOUIS, MISSOURI 63101

IN REPLY REFER TO

21 April 1980

LMSED-P

SUBJECT: Old Mines Tailings Dam, MO 30706 Phase I Inspection Report.

This report presents the results of field inspection and evaluation of the Old Mines Tailings Dam.

It was prepared under the National Program of Inspection of Non-Federal Dams.

This dam has been classified as unsafe, non-emergency by the St. Louis District as a result of the application of the following criteria:

1. Spillway will not pass 50 percent of the Probable Maximum Flood without overtopping the embankment and without significant erosion of the spillway and embankment.

2. Overtopping of the dam and/or significant erosion of the spillway could result in failure of the dam.

3. Dam failure significantly increases the hazard to loss of life downstream.

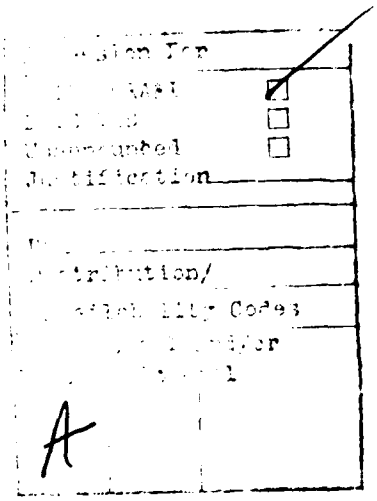
For Phase I reports, the extent of the downstream damage zone has been determined assuming that all materials contained by the tailings dam are in a liquid state.

SUBMITTED BY: SIGNED
Chief, Engineering Division

10 JUN 1980
Date

APPROVED BY: SIGNED
Colonel, CE, District Engineer

10 JUN 1980
Date



PHASE I REPORT

NATIONAL DAM SAFETY PROGRAM

Name of Dam	Old Mines Tailings Dam
State	Missouri
County	Washington
Stream	Mud Town Creek
Date of Inspection	24 August 1979

Old Mines Tailings Dam, I.D. No. 30706, was inspected by two civil engineers from International Engineering Company, Inc., of San Francisco, California. This dam is owned by General Barite Company of DeSoto, Missouri. The purpose of the inspection was to assess the general condition of the dam with respect to safety. The assessment was based on an evaluation of the available data, a visual inspection, and an evaluation of the hydrology and hydraulics of the site to determine if the dam poses hazards to human life or property. The purpose of the dam is to impound tailings from a barite separation and beneficiation operation.

Old Mines Tailings Dam was inspected using the "Recommended Guidelines for Safety Inspection of Dams" furnished by the Department of the Army, Office of the Chief of Engineers. Based on these Guidelines, this dam is classified as intermediate size. The St. Louis District Corps of Engineers has classified this dam as having a high downstream hazard potential to indicate that failure of this dam could threaten life and property. The estimated damage zone provided by the St. Louis District Corps of Engineers extends approximately six miles downstream of the dam. Information provided by the Corps of Engineers indicates that 25 dwellings and a highway are within this damage zone.

The results of the inspection and evaluation indicate that the spillway does not meet the criteria given in the Guidelines for a dam with the size and hazard potential of Old Mines Tailings Dam. As an intermediate size dam with a high hazard potential, the Guidelines specify that the discharge capacity and/or storage capacity should be capable of safely handling the Probable Maximum Flood (PMF) without overtopping the crest. The PMF is the flood that may be expected from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably possible in the region.

It is calculated that the spillway can pass a 100-year flood (a flood having a one percent chance of being equalled or exceeded in any one year) without overtopping the dam and without significant erosion of the spillway or embankment. It is estimated that the spillway can pass 42 percent of the PMF without overtopping the dam. However, at 42 percent of the PMF the peak spillway outflow has a velocity which could

cause significant erosion of the spillway and embankment. It is also estimated that the spillway can pass 15 percent of the PMF without overtopping the dam and without significant erosion of the spillway or embankment. The spillway cannot pass 50 percent of the PMF without overtopping and significant erosion.

The spillway capacity should be increased and/or adequate freeboard provided so that the PMF can be passed without overtopping the dam. Adequate erosion protection should be provided so that the PMF can be passed without significant erosion of the spillway or embankment. The existing shallow spillway channel terminates on the right abutment hillside above the natural drainage. A more distinct channel should be cut downstream of the crest, and the spillway channel should be extended to the natural drainage channel or a sufficient distance downstream so that any discharge will not undercut and erode the toe of the dam or its foundation.

Considerable seepage and ponded water exists along a majority of the downstream embankment toe, and the soils in these areas are soft and saturated. This soft foundation soil condition and the steep downstream embankment slope could adversely affect the stability of the dam. Seepage and ponded water should be drained to remove water which saturates and weakens foundation soils.

Seepage and stability analyses of this dam are not available. These studies should be performed by a professional engineer experienced in the design and construction of tailings dams and should be made a matter of record. The necessary data for these analyses would be obtained from additional investigations. The investigation would consist of field exploration and soil sampling, a laboratory testing program, and an engineering study to evaluate the stability of the dam. Based on the results of these analyses, remedial measures may become necessary. Remedial work should be performed under the direction of an engineer experienced in the design and construction of tailings dams.

An inspection and maintenance program should be initiated. Periodic inspections should be made and documented by qualified personnel to observe the performance of the dam and spillway.

It is recommended that the owner take action to correct the deficiencies described.

Kenneth B. King, P.E.

Stanley H. Kline, P.E.

James H. Gray, P.E.

OVERVIEW OF OLD MINES TAILINGS DAM - I.D. NO. 30706
FROM A LOCATION DOWNSTREAM OF RIGHT ABUTMENT

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
OLD MINES TAILINGS DAM
ID NO. 30706

TABLE OF CONTENTS

APPENDIX A

HYDROLOGIC AND HYDRAULIC ANALYSES

APPENDIX B

INFORMATION SUPPLIED BY OTHERS

LIST OF PLATES

PHOTOGRAPHS

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
OLD MINES TAILINGS DAM - ID NO. 30706

SECTION 1 - PROJECT INFORMATION

1.1 GENERAL

a. Authority. The National Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of safety inspection of dams throughout the United States. Pursuant to the above, the St. Louis District, Corps of Engineers, District Engineer directed that a safety inspection of the Old Mines Tailings Dam be made and authorized International Engineering Company, Inc. to make the inspection.

b. Purpose of Inspection. The purpose of the inspection was to assess the general condition of the dam with respect to safety, based on available data and visual inspection, to determine if the dam poses hazards to human life or property.

c. Evaluation Criteria. Criteria used to evaluate the dam were furnished by the Department of the Army, Office of the Chief of Engineers, in "Recommended Guidelines for Safety Inspection of Dams". These Guidelines were developed with the help of several Federal agencies and many state agencies, professional engineering organizations, and private engineers.

1.2 DESCRIPTION OF PROJECT

a. Description of Dam and Appurtenances.

(1) Old Mines Tailings Dam is a cross-valley earthfill dam that is used to impound tailings from a barite separation and beneficiation operation. The dam is being continually raised to provide storage for tailings. The tailings consist of reddish-brown soft silty clay, which is being deposited as a slurry in a water environment.

(2) The spillway is a shallow open channel cut into natural clayey soil on the right abutment. The spillway approach channel is an uncontrolled open channel of trapezoidal cross section cut into natural clayey soil along the east side of the impoundment.

b. Location. The dam is located in the northeastern portion of Washington County, Missouri, as shown on Plate 1. The dam, shown on Plate 2, is located in MO Survey 3039, Township 38 North, Range 3 East.

c. Size Classification. Old Mines Tailings Dam is greater than 40 feet but less than 100 feet high, and the impoundment storage is less than 50,000 acre-feet; therefore, this dam is classified as an intermediate size dam in accordance with the "Recommended Guidelines for Safety Inspection of Dams".

d. Hazard Classification. This dam is classified as having a high hazard potential by the St. Louis District Corps of Engineers. The estimated damage zone, as provided by the St. Louis District Corps of Engineers, extends approximately six miles downstream of the dam. Information provided by the Corps of Engineers indicates that 25 dwellings and a highway are within this damage zone.

e. Ownership. This dam is owned by:

General Barite Company
402 South Second Street
DeSoto, MO 63020

f. Purpose of Dam. The purpose of the dam is to impound the tailings from a barite separation and beneficiation operation.

g. Design and Construction History. No written design or construction data were available. Mr. Charles M. Faulkner, President of General Barite Company, indicated that construction of a clay starter dam began in about 1967. After construction of the starter dam, sand and angular gravels, finer than 7/8-inch, from the mill operation were used to raise the dam. Larger waste rock was dumped on the downstream slope. The dam is continually raised to provide additional tailings storage capacity.

h. Normal Operating Procedures. Fine barite tailings are discharged in a slurry form from the mill and deposited by gravity flow into the impoundment near the upstream face of the dam at the left abutment. Water collected at the upstream end of the impoundment is separated from the tailings by a gravel dike along the southwestern side of the impoundment. The water is recycled back to the mill. The outflow of surface runoff would pass through an uncontrolled spillway located at the right abutment. No operating records for this dam are known to exist.

1.3 PERTINENENT DATA

Field surveys were made by Booker Associates, Inc. of St. Louis, Missouri on 11 September 1979. Field measurements are valid as of the dates of inspection and survey. The survey data is presented on Plates 3 through 8.

a. Drainage Area - 326 acres (Surdex aerial photograph, scale: 1 inch = 1000 feet, 14 June 1978).

b. Discharge at Damsite.

(1) Outlet pipe - There is no outlet pipe at this dam. Not applicable.

(2) Spillway discharge for pool at top of dam (El. 887.2 feet) - 755 cfs.

(3) Maximum experienced outflow at damsite - No available information.

c. Elevation (Feet Above M.S.L.)[1/]

(1) Top of dam - Varies from El. 887.2 to El. 895.4.

(2) Streambed at downstream toe of dam - El. 830±.

(3) Maximum pool (PMF) - El. 888.5.

(4) Operating pool - El. 883.2 on 11 September 1979.

(5) Spillway crest - El. 885.0.

(6) Tailings surface adjacent to dam - Varies from El. 884.5 to El. 891.2.

d. Reservoir.

(1) Length of maximum pool - 2500± feet (Surdex aerial phototgraph, scale: 1 inch = 1000 feet, 14 June 1978).

(2) Length of operating pool - 1200± feet (Surdex aerial photograph, scale: 1 inch = 1000 feet, 14 June 1978).

(3) Length of impounded tailings - 2500± feet (Surdex aerial photograph, scale: 1 inch = 1000 feet, 14 June 1978).

e. Storage Above Tailings Surface.

(1) Top of dam (El. 887.2 feet) - 286 acre-feet.

(2) Operating pool (El. 883.2 feet on 11 September 1979) - 38 acre-feet.

(3) Spillway crest (El. 885.0 feet) - 126 acre-feet.

1/ Elevations are based on a reference elevation of 890.00 feet M.S.L. estimated from the Tiff, Mo., 1937, 7.5 minute series, topographic quadrangle. A temporary bench mark at El. 890.92 feet was established from this reference (Plate 3).

f. Reservoir Surface Area.

(1) Top of dam (El. 887.2 feet) - 81 acres.

(2) Operating pool (El. 883.2 feet on 11 September 1979) - 36 acres.

(3) Spillway crest (El. 885.0 feet) - 63 acres.

g. Dam.

(1) Type - Earthfill.

(2) Crest length - 1720 ± feet.

(3) Height (maximum above streambed) - 61 feet at Station 10+82.

(4) Crest width - 50 to 60 feet.

(5) Side slopes -

(a) Downstream slope - Approximately 1.4 (H) to 1.0 (V).

(b) Upstream slope - Unknown.

(6) Zoning - The zoning of the dam consists of a clay starter dam, which is overlain by sands and angular gravels. Larger waste rock and boulders are dumped on the downstream slope. The sands, gravels, and rock result from the barite ore milling process, and the gravels are finer than 7/8-inch.

(7) Cutoff - No written information was available to indicate that a cutoff was designed or constructed. Mr. Charles M. Faulkner, President of General Barite Company, stated that the clay starter dam has a key trench but was unable to provide information as to its depth or whether it was extended to bedrock or not.

h. Spillway.

(1) Type - Uncontrolled open channel at right abutment.

(2) Control section - The depression at the right abutment in the dam crest, which is used as a haul road, would function as a broad-crested weir of varying width (Station 1+80 to 3+60).

(3) Crest elevation - El. 885.0 feet.

(4) Upstream channel - 1230-foot long open channel of trapezoidal cross section cut into natural clayey soil along the east side of the impoundment.

(5) Downstream channel - Shallow cleared section which drains into open cut trapezoidal channels, erosion gullies, and unchanneled natural ground which meander adjacent to dam toe and drain into marshy area immediately downstream of the dam at its maximum section and into Mud Town Creek.

i. Regulating Outlets. - None.

j. Diversion Ditches. - None.

SECTION 2 - ENGINEERING DATA

2.1 DESIGN

No design drawings or data are known to exist.

2.2 CONSTRUCTION

No construction records were available. Information concerning construction of the dam was provided verbally by Mr. Charles M. Faulkner, President of General Barite Company. Mr. Faulkner indicated that the mill, which is situated on the hill above the left abutment, was constructed in 1965, and construction of the dam began in about 1967. He stated that a clay starter dam was built by a highway contractor with the use of scrapers and that the dam has a key trench. The only drawing of the dam that Mr. Faulkner was aware of is a sketch prepared for figuring quantities for payment. This sketch could not be found, and no information regarding the slopes, crest width, or height of the starter dam or the depth of the key trench could be obtained.

During subsequent operation of the impoundment, sand and angular gravels, finer than 7/8-inch, resulting from the barite ore milling process were used to raise the dam to provide additional tailings storage capacity. Larger waste rock was dumped on the downstream slope. The material was hauled to the crest by truck and placed with spreading equipment. Excess material was pushed over the upstream and downstream faces of the dam. The sands, gravels, and larger rock placed in this manner are in a loose state and are at or near their natural angle of repose on the downstream face. The material pushed over the upstream side rests on the tailings. The centerline of the dam remains approximately at the same position as the embankment is raised. Compaction of the material on the crest is by construction equipment; the crest is used as a haul road.

Presently, the construction is proceeding in the same manner. Material from the barite ore milling process is hauled to the dam by truck and dumped in windrows along the upstream and downstream edge of the crest, and the dam crest haul road is raised between the windrows. The finer sands and gravels are dumped on the upstream windrow and placed along the crest. The larger material is dumped on the downstream window and on the downstream slope. Clearing of brush and trees is not evident along the downstream toe of the dam as it progresses downstream. Dumping of some rubbish, twigs, roots, and branches on the downstream face was noticed at the time of inspection.

Mr. Faulkner indicated that spillway construction has proceeded up the right abutment as the dam has been raised. Construction of a new spillway was just completed prior to this inspection. A 1230-foot long spillway approach channel was cut into the natural clayey soil along the east side of the impoundment with a dragline. The old spillway approach channel was evident directly to the west. At the time of inspection it appeared that the outflow of surface runoff would pass through both the

old and new approach channels and would combine at the depression in the dam crest between the two channels and would continue down the right abutment along the toe of the dam. Mr. Faulkner indicated that as the dam crest is raised, flow from the old spillway approach channel would be cut off, and the depression in the dam crest would become more pronounced at the location of the new approach channel. A distinct channel is not cut through the dam crest at the right abutment to join the approach channel, however, since the crest is used as a haul road.

A report by J. H. Williams of the Missouri Geological Survey dated 23 September 1975 and entitled "Engineering Geologic Report on General Barite Mining Tailings Pond" indicates that the dam had evidence of substantial stability. This report is presented in Appendix B.

2.3 OPERATION

No operating records are known to exist. Fine barite tailings are discharged in a slurry form from the mill and deposited by gravity flow into the impoundment near the upstream face of the dam at the left abutment. Water collected at the upstream end of the impoundment is separated from the tailings by a gravel dike along the southwestern side of the impoundment. The water is recycled back to the mill. The outflow of surface runoff would pass through an uncontrolled spillway located at the right abutment.

2.4 EVALUATION

a. Availability. No design or construction records were available. The only design and construction information available to the inspection team was that obtained through verbal communication with Mr. Charles M. Faulkner, President of General Barite Company.

b. Adequacy. The field surveys and visual inspections presented herein are considered adequate to support the conclusions of this report. Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" were not available, and this lack of information is considered a deficiency. These seepage and stability analyses should be performed for appropriate loading conditions, including earthquake loads, and made a matter of record.

c. Validity. Not applicable because no design data were available.

SECTION 3 - VISUAL INSPECTION

3.1 FINDINGS

a. General. The dam was inspected by two civil engineers from International Engineering Company, Inc. on 24 August 1979. Mr. Charles M. Faulkner, President of General Barite Company, met with the inspection team on 22 August 1979 to tour the damsite and provide information about the construction and operation of the impoundment. The impoundment created by Old Mines Tailings Dam is currently in use as a barite tailings storage site. The dam is continually being raised to provide additional tailings storage capacity. Photographs taken during the inspection are included in this report. Field locations of the photographs are shown on Plate 9.

b. Project Geology. The impoundment watershed is covered by a residual reddish-brown clay containing gravel and rock fragments of barite, chert, and quartz druse. Soil cover appears to be generally less than 15 feet thick. The underlying bedrock is mapped as gray dolomite of the Cambrian age Potosi Formation. Bedrock was exposed in mined areas at the back of the impoundment in the southeastern portion of the watershed.

c. Dam. The plan of the dam is shown on Plate 3. The profile and cross sections of the dam, spillway, and spillway approach channel are shown on Plates 4 through 8.

There is essentially no vegetation on the embankment itself. Some trees and brush are growing through the embankment at the left abutment and appear to be rooted in the natural soils. Some trees and brush that were not cleared as the dam was raised are growing through the embankment near the downstream dam toe. Lush vegetation consisting of trees, brush, and grasses exist immediately downstream of the dam. Clumps of weeds are growing on the tailings surface in the area adjacent to the dam.

Based on visual inspection, no evidence of detrimental settlement, depressions, cracks, sinkholes, erosion, piping, or animal burrows were observed in or near the dam. It is doubtful, however, such features would be apparent because of con tinual addition of gravel and rock fill. Minor surface erosion was evident at a few locations on the downstream face due to runoff. No major erosion was visible on either the upstream or downstream slope. Surface ravelling was noted at several locations along the downstream slope of the dam. Dumping of material onto the face of the dam probably causes this ravelling since the gravels and rock are standing at or near their natural angle of repose. A buldge in the lower half of the dam near the maximum section at Station 12+10 was observed. It appeared that this was caused by a shallow slide or slump on the downstream face. Trees and brush at the toe in this location were obviously tilted out from the toe by movement of embankment material. Heaving

of the ground downstream of the dam was not evident. It did not appear that what caused this protrusion at the base of the dam resulted in any detrimental affects to the stability of the dam, and because of the nature of the embankment material it was not clearly evident whether or not it was caused from a shallow slide, ravelling, or simply by the way material was dumped and deposited over the crest of the dam onto the downstream face.

Seepage and ponded water was evident along a majority of the dam toe. No seepage issuing from the dam face itself was observed. Ponded water, up to six inches deep, was encountered along most of the western half of the dam below the downstream toe from Station 12+00 to Station 17+00. Throughout this area, the ground was soft and saturated. The marshy ground extended several hundred feet downstream of the dam toe. Seepage was observed flowing from the toe of the dam at its maximum section, Station 10+82, at approximately 1 to 2 gpm. Percolation through the dam beneath the face was audible. Other major seeps along the dam toe were noted at Station 5+92 and Station 4+04 flowing at an estimated 2 to 3 gpm and 1/2 to 1 gpm respectively. All seepage observed appeared to be clear, and no evidence of piping was observed. Some of the seeps had an orange-red oily appearance, but flow was clear. Seepage emerging from the toe along the eastern half of the dam has formed erosion gullies that meander down the slope adjacent to the dam toe to the bottom of the drainage draw. Parts of these gullies or channels may be remains of previous downstream spillway channels.

The elevation difference between the dam crest and the tailings surface adjacent to the dam ranged from about 2 to 6 feet on the date that the survey was made (11 September 1979). The elevation difference between the low point in the dam crest and the spillway crest was 2.2 feet on the date of survey. There is no slope protection on the upstream slope which is composed of sands and angular gravels, finer than 7/8-inch. The only slope protection on the downstream slope is provided by the larger waste rock from the barite mining. This rock varies in size from 4 and 6 inches to boulder sizes having a dimension as large as 3 and 4 feet. It is dumped randomly onto the downstream face from the crest and does not blanket the entire face of the dam. The slope is at or near the angle of repose for these materials.

No evidence of instability was observed at either abutment. Both abutments are covered with residual reddish-brown clayey soil with gravel and rock fragments. Some seepage along the downstream toe on the right abutment was observed as described earlier. There was no evidence of clearing or stripping of trees and underbrush on the left abutment. Strip mining activity has occurred at the right abutment.

d. Appurtenant Structures. The only appurtenant structure associated with the dam is the spillway at the right abutment. The spillway consists of a 1230-foot long approach channel upstream of the dam excavated in natural clayey soil along the east side of the impoundment and a shallow cleared section approximately 150 feet long adjacent to and

downstream of the dam toe on the right abutment. Construction of the spillway and spillway approach channel was just completed prior to this inspection to replace the previous spillway immediately to the west which no longer exists due to dam enlargement. The old spillway approach channel was evident directly to the west of the newly cut channel.

The spillway approach channel was excavated using a dragline. Material that was excavated to form the channel is piled along the west side of the channel to form its west bank. The channel bottom varies in width between about 10 and 30 feet and is very irregular. Side slopes are variable from about 0.5(H) to 1.0(V) to 2.0(H) to 1.0(V). The approach channel profile and cross sections are shown on Plates 6A and 7 respectively. A depression in the dam crest at the right abutment forms the spillway control section. A distinct channel is not cut into the abutment at this location to join the spillway approach channel, because the dam crest is used as a haul road.

The channel downstream of the spillway crest is a shallow stripped section consisting of freshly cut clumps of clayey soil along the downstream toe, which terminates on the right abutment hillside. The profile is shown on Plate 6B. At the location where the channel rounds the dam crest to proceed down the abutment, the channel bottom slopes toward the toe of the dam. Beyond the point where the cleared section terminates, flow would pass over the natural ground and would be channeled through erosion gullies caused by seepage and through sections of open cut trapezoidal channels which appear to have been associated with earlier spillways, meandering down the right abutment hillside adjacent to the dam to the natural stream channel. No erosion was observed in the spillway or spillway approach channel; however, these channels were recently constructed and had probably not functioned prior to inspection.

e. Reservoir Area. No evidence of landsliding was observed in the reservoir area. There are no upstream structures within the watershed of this dam that would be subjected to backwater flooding. Most of the watershed toward the back of the impoundment is abandoned strip mine. Drainage is interrupted in this area and is often ponded. Erosion was noted in watershed drainage channels within the strip mine area. Undisturbed forest land exists along the sides of the tailings pond, and very little erosion has occurred in these areas. The tailings in the impoundment consist of soft silty clay that is being deposited by hydraulic methods. Minimal consolidation of the tailings has probably taken place.

f. Downstream Channels. Discharge from the spillway channel would flow down the right abutment hillside, for a vertical distance of about 60 feet, into a marshy area in the natural downstream channel of Mud Town Creek. The natural stream channel of Mud Town Creek below the dam is undeveloped and heavily forested.

3.2 EVALUATION

Minimal consolidation of the silty clay tailings has probably taken place. Therefore, the dam is effectively retaining a material with very low strength. The tailings exert a high pressure that the dam must resist.

The embankment is a relatively porous granular structure above the tailings surface. If the water level were to rise above the tailings surface due to flood runoff, there could be significant seepage through the embankment which could adversely affect the stability of the dam.

Considerable seepage and ponded water exists along a majority of the downstream toe, and marshy conditions extend several hundred feet downstream of the western half of the dam. The soils in these areas are soft and saturated. As the dam is continually raised, the downstream slope is constructed in the downstream direction over these soft foundation soils. No clearing of foliage appears to be done as the base of the dam moves downstream, and the downstream embankment slope stands at or near the angle of repose of the gravels and rock that are dumped on the slope. Although no slope instability other than minor surface sliding or ravelling, which is probably due to dumping of material over the crest, was observed, the long-term stability of the dam can not be evaluated until seepage and stability analyses are performed. The soft foundation soil condition and steep downstream embankment slope could cause potential instability of the embankment as the dam is raised.

The unlined clayey spillway and spillway approach channel, and the dam crest at the right abutment which functions as the spillway crest are subject to erosion due to heavy flood discharges. The spillway channel does not extend to the natural drainage channel downstream of the dam and it does not direct flow away from the embankment toe. Since the spillway channel abuts the dam, flood flows could erode embankment materials, and since the channel terminates on the right abutment hillside, allowing discharge to meander down the slope adjacent to the dam on its own course, flood discharge could erode soils downstream of the dam and/or the embankment.

The elevation difference between the low point on the dam crest and the spillway crest was 2.2 feet on the date of survey. The spillway crest was at El. 885.0 feet and the low point on the dam crest was at El. 887.2 feet. The tailings surface adjacent to the dam varied from El. 884.5 feet to El. 891.2 feet. Although the dam is continually being raised and field measurements are only valid as of the dates of insepction and survey, it is evident that water would be impounded adjacent to the dam before discharge through the spillway would occur and freeboard would be minimal if the relative differences in the spillway crest, dam crest, and tailings surface elevations were the same as measured on 11 September 1979. This condition increases the possibility of significant seepage through the embankment as discussed above.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 PROCEDURES

No regulating procedures are known to exist for this dam. The dam is continually being raised to provide additional tailings storage capacity. Fine barite tailings are discharged in a slurry form from the mill by gravity flow into the impoundment near the upstream face of the dam at the left abutment. Water collected at the upstream end of the impoundment is separated from the tailings by a gravel dike along the southwestern side of the impoundment. The water is recycled back to the mill. The outflow of surface runoff would pass through an uncontrolled spillway located at the right abutment.

4.2 MAINTENANCE OF DAM

The embankment is currently being enlarged to provide additional tailings storage capacity, and, therefore maintenance of the dam is not strictly practiced. Sand, gravel, and larger rock materials are being dumped along the dam crest in windrows and in the downstream direction over the crest. New spillways and approach channels are constructed on the right abutment hillside as the dam is raised.

4.3 MAINTENANCE OF OPERATING FACILITIES

There are no operating facilities at this dam. Not applicable.

4.4 DESCRIPTION OF WARNING SYSTEM IN EFFECT

Information available to the inspection team indicates that there is no warning system for this dam.

4.5 EVALUATION

The behavior of the dam should be monitored periodically to observe any indications of instability, such as cracks in the dam, sloughing, sudden settlement, erosion of the dam or spillway, or an increase in the volume or turbidity of emerging seepage.

SECTION 5 - HYDRAULIC AND HYDROLOGIC ANALYSES

5.1 EVALUATION OF FEATURES

Hydraulic and hydrologic anlayses were made by Sierra Hydrotech of Placerville, California.

a. Design Data. The significant dimensions of the dam and spillway are presented in Section 1 - Project Information and in the accompanying field survey drawings, Plates 3 through 8. No hydrologic or hydraulic design information is available.

For this evaluation, stream lengths and slopes were obtained from the USGS Tiff, Mo., 1937, 7.5 minute series, 1:24,000 scale, topographic quadrangle. The watershed drainage area and reservoir areas were obtained from a Surdex aerial photograph, scale: 1 inch = 1000 feet, 14 June 1978. The watershed drainage area was checked against an area obtained from the USGS quadrangle, and was found to be in reasonable agreement. The soil group for this watershed is classified as Clarksville Gravelly Loam, equivalent to a hydrologic soil group B classification, which has a moderate rate of water transmission.

The drainage area, as shown on Plate 2, is about 326 acres (0.51 square miles). Land use and vegetation patterns in the watershed were determined from field observations and aerial photographs of the project area. These patterns were divided into the following categories:

Type of Cover	Approximate Percent of Watershed
Water	11
Tailings	12
Roads and Mine Facilities	2
Grassland	2
Woodland	43
Revegetated Strip Mine	30

Based on the above, the estimated curve numbers (CN) weighted for the entire watershed are CN 58 for the antecedent moisture condition (AMC) II condition and CN 76 for the AMC III condition.

The revegetated strip mine areas are abandoned barite mining sites. These areas consist of irregular scars on the topography with some mining pits as much as ten feet deep. These areas were assigned a lower curve number in calculating the weighted basin runoff curve number. The basin parameters such as basin lag time, unit hydrograph, and probable maximum precipitation are presented in Appendix A.

The dam is continually being raised and construction of a new spillway and spillway approach channel near the right abutment of the dam was just completed prior to this inspection. The old spillway approach

channel leading from the tailings pond to the dam crest adjacent to the new channel was evident. At the time of inspection, it was evident that flood discharges would flow through both channels separately, until reaching the dam crest at which point the flows would combine. The channels are separated by material excavated from the new spillway approach channel and waste gravels from the mill. These channels are indicated on Plate 3. A profile and cross sections of the new spillway and spillway approach channel were surveyed and are shown on Plates 6, 7, and 8. Backwater analysis indicated that most of the flow would reach the spillway from the old spillway approach channel and that there would be no significant backwater impact of these approach channels at flows produced by the probable maximum flood. Therefore, the spillway rating is set by the characteristics of the control section along the alignment of the dam crest (see Plate 4A). Downstream from the crest the channel section and slope have sufficient capacity and will not control spillway flow.

The spillway crest is at El. 885.0 feet which occurs along the upstream side of the dam crest between station 2+22 and 2+60 of the dam crest profile. The single gravel windrows along the edges of the dam crest were neglected in selecting crest elevations. The minimum dam crest elevation is located at Station 5+00 of the dam crest profile and is El. 887.2 feet. Computations of the discharge rating curve for flows in the spillway and over the dam crest were made by using the weir flow formula with a weir coefficient of C = 2.7 for the spillway and dam crest. The combined discharge rating curve data for flows in the spillway and over the dam crest is shown in Appendix A, under the input data listing as Y4 and Y5 cards, and also in the computer printout.

The reservoir area-capacity curve data is shown in Appendix A. The capacities shown, as computed by the Conic Method in the computer program, are the active capacities at the given elevations above the tailings.

b. Experience Data. Recorded rainfall, runoff, or other experience data are not available. There is no evidence of historic dam overtopping.

c. Visual Observations. The open channel spillway is located at the right abutment of the dam. Specific information on the visual observations is presented in Section 3 - Visual Inspection.

d. Overtopping Potential. The 100-year flood, probable maximum flood (PMF), and floods expressed as percentages of the PMF were computed and routed through the reservoir and spillway. The PMF is defined as the hypothetical flood event that would result from the most severe combination of critical meteorologic and hydrologic conditions that is reasonably possible at a particular location or region. The Modified Puls method of spillway routing was employed.

For all cases of the spillway flood routing, the initial level of the reservoir surface was set at the spillway crest El. 885.0 feet at the start of the flood. Dam overtopping was considered to start when the reservoir water surface exceeded El. 887.2 feet. It was assumed that

the spillway-embankment section would not change due to erosion as the flood discharge occurs; therefore, the combined discharge rating curve for flows in the spillway and over the dam crest is constant throughout the period of flood discharge.

Results of the overtopping analyses indicate that the spillway is able to pass the 100-year flood. The studies also indicate that the spillway can pass about 42 percent of the PMF without overtopping the embankment. However, at 42 percent PMF, the peak spillway outflow is about 755 cfs, with a flow depth of 1.8 feet and a flow velocity of about 5.2 feet per second. Velocities in the channel downstream of the crest adjacent to the embankment toe would be greater. Discharge velocities such as those at 42 percent PMF peak outflow could cause significant erosion of the spillway and embankment.

A major consideration in evaluating the safety of the dam is assessing the potential for overtopping and the subsequent failure of the embankment as the result of erosion. Since the spillway is composed of erodible materials, high velocity discharges through the spillway will lead to significant erosion of the spillway and embankment even if the dam is not overtopped. Based on the Corps of Engineers Manual EM 1110-2-1601, "Hydraulic Design of Flood Control Channels", the maximum permissible velocity for the materials found in the spillway section is about four feet per second. Using this as a criterion, the spillway can pass the 100-year flood. Based on studies at 14 percent and 16 percent of the PMF, it was estimated that the spillway can pass about 15 percent of the PMF without significant erosion. The 15 percent PMF routed outflow is 160 cfs, with a flow depth of 0.9 feet. Thus, for determining the spillway erosion potential, flow velocities in the spillway channel higher than four feet per second or a reservoir water surface elevation exceeding El. 886.1 feet are considered to produce the effects of embankment failure.

The results of the overtopping analyses are reported in Appendix A and are summarized on the following page.

Flood	Peak Inflow (cfs)	Peak Outflow (cfs)	Max. Res. W.S.Elev. (ft)	Spillway Flow Depth (ft)	Spillway Flow Velocity (ft/sec)	Duration Spillway Vel. over 4.0 ft/sec (hr)
14% PMF	585	146	886.0	0.8	3.8	-
16% PMF	696	182	886.1	0.9*	4.1*	2.3
40% PMF	1671	704	887.1	1.7*	5.2*	6.8
50% PMF	2089	975	887.4**	2.0*	5.4*	7.9
75% PMF	3134	1841	888.0**	2.5*	5.8*	8.9
PMF	4179	2736	888.5**	2.9*	6.2*	10.8

---

* These flow depths and velocities are considered to produce the effects of significant erosion.

** Dam overtopped (Minimum dam crest El. 887.2 feet).

Note: Reservoir water surface elevations include the velocity heads corresponding to the velocities computed at the spillway control section.

SECTION 6 - STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

a. Visual Observations. Conditions that may adversely affect the structural stability of the dam are discussed in Section 3.

b. Design and Construction Data. No design or construction data pertaining to the structural stability of the dam were available. Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" were not available, and lack of this information is considered a deficiency. These seepage and stability analyses should be performed for appropriate loading conditions, including earthquake loads, and made a matter of record.

c. Operating Records. No appurtenant structures requiring operation exist at this dam and no records are known to exist.

d. Post-Construction Changes. The dam is currently being raised. Not applicable.

e. Seismic Stability. The dam is located in Seismic Zone 2, as defined in the Uniform Building Code. There appears to be a potential for instability caused by ground shaking during earthquakes where the dam overlies soft saturated clay foundation soil. Some crest settlement and ravelling of the embankment gravels could also occur during seismic shaking, because the gravels are in a loose state and are at or near their natural angle of repose on the downstream face.

SECTION 7 - ASSESSMENT/REMEDIAL MEASURES

7.1 DAM ASSESSMENT

a. Safety. The Old Mines Tailings Dam has several deficiencies that should be corrected. (1) No erosion protection has been provided in the spillway channel. Since the spillway channel terminates on the right abutment hillside above the natural stream channel and is aligned adjacent to the dam toe, discharge through the channel could erode soils downstream of the dam and/or the embankment. (2) The seepage occurring along a majority of the downstream toe and the ponded water and marshy conditions that exist downstream of the western half of the dam which are creating soft saturated foundation soil conditions could adversely affect the stability of the dam. (3) Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" were not available, and they should be performed and made a matter of record. (4) The discharge capacity of the spillway was computed to be inadequate to pass 50 percent of the Probable Maximum Flood (PMF) without overtopping the dam and without significant erosion of the spillway and embankment. The PMF is the flood that may be expected from the most severe combination of critical meteorologic and hydrologic conditions that is reasonably possible in the region. The "Recommended Guidelines for Safety Inspection of Dams" specifies that the spillway design flood for this dam should be the PMF.

b. Adequacy of Information. No detailed design or construction data were available. Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" were not available, and this lack of data is considered a deficiency.

The only available topographic map at the time of this inspection is the USGS Tiff, Mo., 1937, 7.5 minute series, 1:24,000 scale, topographic quadrangle with contour intervals of 20 feet. Results of the hydrologic studies could be changed if larger scale and more up to date topographic maps with smaller contour intervals were used. The maps would also show the mining and dam construction which has occurred subsequent to the publication of the quadrangle map. The watershed drainage area and reservoir areas were measured from a Surdex aerial photograph, scale: 1 inch = 1000 feet, 14 June 1978. Reservoir area-capacity data was developed using survey measurements and constructing topographic contours on the aerial photograph. This data is considered to be adequate for the Phase I inspection; however, the use of the USGS quadrangle and the aerial photograph for the hydrologic studies results in an approximate evaluation of the spillway flood discharge capacity and embankment overtopping potential.

c. Urgency. The Phase I inspection indicated apparent deficiencies in the condition of the dam. Seepage and stability analyses, and measures to increase the spillway capacity and/or freeboard and to provide the spillway with adequate erosion protection should be given priority.

d. Necessity for Phase II. No Phase II investigation is recommended; however, additional investigations are recommended as outlined in Section 7.2.d.

7.2 REMEDIAL MEASURES

The following remedial measures are recommended:

a. Control and Drainage of Seepage. Specific remedial work should be addressed to controlling seepage and safely conducting it away from the toe of the dam to prevent ponding and saturation of foundation soils. Seepage that presently ponds downstream of the western half of the dam should be drained to remove water which saturates and weakens foundations soils.

b. Spillway Erosion Protection. Adequate erosion protection should be provided on the spillway channel bottom and side slopes. This is especially important where the spillway rounds the embankment at the right abutment adjacent to the toe. The erosion protection should be capable of withstanding the peak discharge velocity resulting from the PMF in areas where erosion of the spillway could extend to the dam. The spillway flow velocities presented in the table in Section 5 are the estimated average velocities at the spillway control section which is the depression in the dam crest at the right abutment. The velocities in the channel downstream of the crest adjacent to the embankment toe would be much greater. A more distinct channel should be cut downstream of the crest, and the spillway channel should be extended to the natural drainage channel or a sufficient distance downstream so that any discharge will not undercut and erode the toe of the dam or its foundation.

c. Spillway Capacity. The existing spillway capacity was calculated to be adequate to pass 42 percent of the PMF without overtopping the dam and 15 percent of the PMF without significant erosion of the spillway and embankment. To comply with the "Recommended Guidelines for Safety Inspection of Dams" for a dam of this size and hazard potential, the spillway capacity should be increased and/or freeboard increased so that the PMF can be passed without overtopping the dam crest and without significant erosion of the spillway or embankment.

d. Seepage and Stability Analyses. Seepage and stability analyses should be performed by a professional engineer experienced in the design and construction of tailings dams. The embankment is a relatively porous granular structure above the tailings surface. If the water level were to rise above the tailings surface adjacent to the dam, there could be significant seepage through the embankment which could adversely affect the stability of the dam. Included in these analyses, therefore, seepage and stability computations should be performed with the reservoir water surface set at the top of the dam. If freeboard will be increased so that the dam will pass the PMF without overtopping, the analyses should be performed with the reservoir water surface set at the maximum pool (PMF) level, and the added embankment height should be considered in the stability analysis.

The necessary data for these analyses would be obtained from additional investigations. The investigations should consist of subsurface exploration and soil sampling and a laboratory testing program to obtain the necessary engineering parameters of the dam and foundation materials. These parameters should be used in an engineering study to evaluate the stability of the dam. Concurrent with the exploratory work, groundwater monitoring wells should be installed in the drill holes to obtain water level data that would be used in the stability studies. Remedial measures to the dam should be based on the results of the stability studies and should be done under the direction of a professional engineer experienced in tailings dam design and construction.

e. Inspection and Maintenance Program. An inspection and maintenance program should be initiated. Periodic inspections should be made by qualified personnel to observe the performance of the dam. Observations should include indications of instability, such as cracks in the embankment, sloughing, erosion, sudden settement, or an increase in the volume or turbidity of seepage. Records of these inspections should be maintained, and all maintenance and remedial measures made to the dam and spillway should be documented.

```
**********************************
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  26 FEB 79
**********************************
    1                 A1          OLD MINES TAILINGS DAM  (MISSOURI)    NO. 30706
    2                 A2          HEC1  PHASE 1 DAM SAFETY INVESTIGATIONS
    3                 A3          RATIOS OF PMF ROUTED THROUGH SPILLWAY AND OVER CREST                SH-20
    4                 B     300       0       5       0       0       0       0       0       0       0
    5                 B1      5
    6                 J       1       6       1
    7                 J1   0.14    0.16     0.4     0.5    0.75     1.0
    8                 K       0    INFL                             1       1
    9                 K1          FLOOD INFLOW TO OLD MINES TAILINGS DAM POND
   10                 M       1       2    0.51                        1                       1
   11                 P       0    25.9     102     120     130
   12                 T                                                       -1      -76
   13                 W2          0.40
   14                 X     -10    -0.1     2.5
   15                 K       1    LAKE                             1       1       1
   16                 K1          FLOOD INFLOW ROUTED OVER OLD MINES TAILINGS DAM SPILLWAY
   17                 Y                               1       1
   18                 Y1      1                                               -85.0      -1
   19                 Y4   85.0    85.5    86.0    86.5    87.0    87.5    88.0    88.5    89.0    89.5
   20                 Y5      0    34.2     136   314.2   593.2    1023  1742.2  2723.3  3962.1  5467.4
   21                 $A      0    35.9    63.2    80.6    98.4    122.
   22                 $E     80    83.2    85.0    87.0    91.0    100.
   23                 $$   85.0
   24                 $D   87.2
   25                 K      99
```

Note: Add 800 feet to elevations shown for true elevation.

```
**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  26 FEB 79
**********

RUN  DATE= 80/01/05.
     TIME= 13.01.08.
```

OLD MINES TAILINGS DAM (MISSOURI) NO. 30706
HEC1 PHASE 1 DAM SAFETY INVESTIGATIONS
RATIOS OF PMF ROUTED THROUGH SPILLWAY AND OVER CREST SH-20

JOB SPECIFICATION

NO	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
300	0	5	0	0	0	0	0	0	0
			JOPER	NWT	LROPT	TRACE			
			5	0	0	0			

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 NRTIO= 6 LRTIO= 1

RTIOS= .14 .16 .40 .50 .75 1.00

********** ********** ********** ********** **********

SUB-AREA RUNOFF COMPUTATION

FLOOD INFLOW TO OLD MINES TAILINGS DAM POND

	ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
	INFL	0	0	0	0	1	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	2	.51	0.00	.51	1.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	25.90	102.00	120.00	130.00	0.00	0.00	0.00

LOSS DATA

LRUPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	-1.00	-76.00	0.00	0.00

CURVE NO = -76.00 WETNESS = -1.00 EFFECT CN = 76.00

UNIT HYDROGRAPH DATA
TC= 0.00 LAG= .40

RECESSION DATA
STRTQ= -10.00 QRCSN= -.10 RTIOR= 2.50

UNIT HYDROGRAPH 26 END OF PERIOD ORDINATES, TC= 0.00 HOURS, LAG= .40 VOL= 1.00

31.	156.	332.	491.	555.	542.	471.	373.	288.	189.
141.	105.	76.	54.	41.	30.	22.	16.	12.	9.

	7.		5.		4.		3.	2.		1.				
								END-OF-PERIOD FLOW						
HO	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	HO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
1.01	.05	1	.01	0.00	.01	5.	1.01	12.35	151	.22	.20	.02	572.
1.01	.10	2	.01	0.00	.01	4.	1.01	12.40	152	.22	.20	.02	626.
1.01	.15	3	.01	0.00	.01	4.	1.01	12.45	153	.22	.20	.02	664.
1.01	.20	4	.01	0.00	.01	4.	1.01	12.50	154	.22	.20	.02	693.
1.01	.25	5	.01	0.00	.01	3.	1.01	12.55	155	.22	.20	.02	716.
1.01	.30	6	.01	0.00	.01	3.	1.01	13.00	156	.22	.20	.02	736.
1.01	.35	7	.01	0.00	.01	3.	1.01	13.05	157	.26	.24	.02	750.
1.01	.40	8	.01	0.00	.01	2.	1.01	13.10	158	.26	.24	.02	768.
1.01	.45	9	.01	0.00	.01	2.	1.01	13.15	159	.26	.24	.02	791.
1.01	.50	10	.01	0.00	.01	2.	1.01	13.20	160	.26	.25	.02	818.
1.01	.55	11	.01	0.00	.01	2.	1.01	13.25	161	.26	.25	.02	847.
1.01	1.00	12	.01	0.00	.01	2.	1.01	13.30	162	.26	.25	.02	875.
1.01	1.05	13	.01	0.00	.01	2.	1.01	13.35	163	.26	.25	.02	899.
1.01	1.10	14	.01	0.00	.01	1.	1.01	13.40	164	.26	.25	.02	919.
1.01	1.15	15	.01	0.00	.01	1.	1.01	13.45	165	.26	.25	.02	934.
1.01	1.20	16	.01	0.00	.01	1.	1.01	13.50	166	.26	.25	.01	945.
1.01	1.25	17	.01	0.00	.01	1.	1.01	13.55	167	.26	.25	.01	955.
1.01	1.30	18	.01	0.00	.01	1.	1.01	14.00	168	.26	.25	.01	962.
1.01	1.35	19	.01	0.00	.01	1.	1.01	14.05	169	.33	.31	.02	971.
1.01	1.40	20	.01	0.00	.01	1.	1.01	14.10	170	.33	.31	.02	986.
1.01	1.45	21	.01	0.00	.01	1.	1.01	14.15	171	.33	.32	.01	1011.
1.01	1.50	22	.01	0.00	.01	1.	1.01	14.20	172	.33	.32	.01	1046.
1.01	1.55	23	.01	0.00	.01	1.	1.01	14.25	173	.33	.32	.01	1084.
1.01	2.00	24	.01	0.00	.01	1.	1.01	14.30	174	.33	.32	.01	1121.
1.01	2.05	25	.01	0.00	.01	1.	1.01	14.35	175	.33	.32	.01	1154.
1.01	2.10	26	.01	0.00	.01	0.	1.01	14.40	176	.33	.32	.01	1180.
1.01	2.15	27	.01	0.00	.01	0.	1.01	14.45	177	.33	.32	.01	1199.
1.01	2.20	28	.01	0.00	.01	0.	1.01	14.50	178	.33	.32	.01	1214.
1.01	2.25	29	.01	0.00	.01	0.	1.01	14.55	179	.33	.32	.01	1225.
1.01	2.30	30	.01	0.00	.01	0.	1.01	15.00	180	.33	.32	.01	1234.
1.01	2.35	31	.01	0.00	.01	0.	1.01	15.05	181	.20	.19	.01	1234.
1.01	2.40	32	.01	0.00	.01	0.	1.01	15.10	182	.40	.39	.01	1230.
1.01	2.45	33	.01	0.00	.01	0.	1.01	15.15	183	.40	.39	.01	1221.
1.01	2.50	34	.01	0.00	.01	0.	1.01	15.20	184	.60	.59	.02	1240.
1.01	2.55	35	.01	0.00	.01	0.	1.01	15.25	185	.70	.69	.02	1305.
1.01	3.00	36	.01	0.00	.01	0.	1.01	15.30	186	1.71	1.67	.04	1479.
1.01	3.05	37	.01	0.00	.01	0.	1.01	15.35	187	2.81	2.76	.05	1867.
1.01	3.10	38	.01	0.00	.01	0.	1.01	15.40	188	1.10	1.09	.02	2484.
1.01	3.15	39	.01	0.00	.01	0.	1.01	15.45	189	.70	.69	.01	3244.
1.01	3.20	40	.01	0.00	.01	0.	1.01	15.50	190	.60	.59	.01	3880.
1.01	3.25	41	.01	0.00	.01	0.	1.01	15.55	191	.40	.40	.01	4179.
1.01	3.30	42	.01	0.00	.01	0.	1.01	16.00	192	.40	.40	.01	4149.
1.01	3.35	43	.01	0.00	.01	0.	1.01	16.05	193	.31	.30	.00	3859.
1.01	3.40	44	.01	.00	.01	0.	1.01	16.10	194	.31	.30	.00	3407.
1.01	3.45	45	.01	.00	.01	0.	1.01	16.15	195	.31	.30	.00	2911.
1.01	3.50	46	.01	.00	.01	0.	1.01	16.20	196	.31	.30	.00	2508.
1.01	3.55	47	.01	.00	.01	0.	1.01	16.25	197	.31	.30	.00	2188.
1.01	4.00	48	.01	.00	.01	0.	1.01	16.30	198	.31	.30	.00	1935.
1.01	4.05	49	.01	.00	.01	0.	1.01	16.35	199	.31	.30	.00	1741.
1.01	4.10	50	.01	.00	.01	1.	1.01	16.40	200	.31	.30	.00	1598.
1.01	4.15	51	.01	.00	.01	1.	1.01	16.45	201	.31	.30	.00	1492.
1.01	4.20	52	.01	.00	.01	1.	1.01	16.50	202	.31	.31	.00	1415.
1.01	4.25	53	.01	.00	.01	2.	1.01	16.55	203	.31	.31	.00	1359.
1.01	4.30	54	.01	.00	.01	2.	1.01	17.00	204	.31	.31	.00	1318.
1.01	4.35	55	.01	.00	.01	3.	1.01	17.05	205	.24	.24	.00	1285.

1.01	4.40	56	.01	.00	.01	3.	1.01	17.10	206	.24	.24	.00	1252.
1.01	4.45	57	.01	.00	.01	3.	1.01	17.15	207	.24	.24	.00	1215.
1.01	4.50	58	.01	.00	.01	4.	1.01	17.20	208	.24	.24	.00	1171.
1.01	4.55	59	.01	.00	.01	4.	1.01	17.25	209	.24	.24	.00	1126.
1.01	5.00	60	.01	.00	.01	5.	1.01	17.30	210	.24	.24	.00	1083.
1.01	5.05	61	.01	.00	.01	5.	1.01	17.35	211	.24	.24	.00	1044.
1.01	5.10	62	.01	.00	.01	6.	1.01	17.40	212	.24	.24	.00	1016.
1.01	5.15	63	.01	.00	.01	6.	1.01	17.45	213	.24	.24	.00	996.
1.01	5.20	64	.01	.00	.01	6.	1.01	17.50	214	.24	.24	.00	983.
1.01	5.25	65	.01	.00	.01	7.	1.01	17.55	215	.24	.24	.00	973.
1.01	5.30	66	.01	.00	.01	7.	1.01	18.00	216	.24	.24	.00	966.
1.01	5.35	67	.01	.00	.01	8.	1.01	18.05	217	.02	.02	.00	950.
1.01	5.40	68	.01	.00	.01	8.	1.01	18.10	218	.02	.02	.00	912.
1.01	5.45	69	.01	.00	.01	9.	1.01	18.15	219	.02	.02	.00	836.
1.01	5.50	70	.01	.00	.01	9.	1.01	18.20	220	.02	.02	.00	727.
1.01	5.55	71	.01	.00	.01	9.	1.01	18.25	221	.02	.02	.00	604.
1.01	6.00	72	.01	.00	.01	10.	1.01	18.30	222	.02	.02	.00	485.
1.01	6.05	73	.06	.01	.05	11.	1.01	18.35	223	.02	.02	.00	405.
1.01	6.10	74	.06	.02	.05	13.	1.01	18.40	224	.02	.02	.00	369.
1.01	6.15	75	.06	.02	.05	18.	1.01	18.45	225	.02	.02	.00	337.
1.01	6.20	76	.06	.02	.04	25.	1.01	18.50	226	.02	.02	.00	308.
1.01	6.25	77	.06	.02	.04	33.	1.01	18.55	227	.02	.02	.00	281.
1.01	6.30	78	.06	.02	.04	42.	1.01	19.00	228	.02	.02	.00	256.
1.01	6.35	79	.06	.02	.04	51.	1.01	19.05	229	.02	.02	.00	234.
1.01	6.40	80	.06	.03	.04	60.	1.01	19.10	230	.02	.02	.00	213.
1.01	6.45	81	.06	.03	.04	68.	1.01	19.15	231	.02	.02	.00	195.
1.01	6.50	82	.06	.03	.04	75.	1.01	19.20	232	.02	.02	.00	177.
1.01	6.55	83	.06	.03	.04	81.	1.01	19.25	233	.02	.02	.00	162.
1.01	7.00	84	.06	.03	.03	87.	1.01	19.30	234	.02	.02	.00	148.
1.01	7.05	85	.06	.03	.03	93.	1.01	19.35	235	.02	.02	.00	135.
1.01	7.10	86	.06	.03	.03	98.	1.01	19.40	236	.02	.02	.00	123.
1.01	7.15	87	.06	.03	.03	103.	1.01	19.45	237	.02	.02	.00	112.
1.01	7.20	88	.06	.03	.03	108.	1.01	19.50	238	.02	.02	.00	102.
1.01	7.25	89	.06	.03	.03	113.	1.01	19.55	239	.02	.02	.00	93.
1.01	7.30	90	.06	.04	.03	117.	1.01	20.00	240	.02	.02	.00	85.
1.01	7.35	91	.06	.04	.03	121.	1.01	20.05	241	.02	.02	.00	85.
1.01	7.40	92	.06	.04	.03	125.	1.01	20.10	242	.02	.02	.00	85.
1.01	7.45	93	.06	.04	.03	129.	1.01	20.15	243	.02	.02	.00	85.
1.01	7.50	94	.06	.04	.03	133.	1.01	20.20	244	.02	.02	.00	85.
1.01	7.55	95	.06	.04	.03	136.	1.01	20.25	245	.02	.02	.00	85.
1.01	8.00	96	.06	.04	.02	140.	1.01	20.30	246	.02	.02	.00	85.
1.01	8.05	97	.06	.04	.02	143.	1.01	20.35	247	.02	.02	.00	85.
1.01	8.10	98	.06	.04	.02	146.	1.01	20.40	248	.02	.02	.00	85.
1.01	8.15	99	.06	.04	.02	149.	1.01	20.45	249	.02	.02	.00	85.
1.01	8.20	100	.06	.04	.02	151.	1.01	20.50	250	.02	.02	.00	85.
1.01	8.25	101	.06	.04	.02	154.	1.01	20.55	251	.02	.02	.00	85.
1.01	8.30	102	.06	.04	.02	157.	1.01	21.00	252	.02	.02	.00	85.
1.01	8.35	103	.06	.04	.02	159.	1.01	21.05	253	.02	.02	.00	85.
1.01	8.40	104	.06	.04	.02	162.	1.01	21.10	254	.02	.02	.00	85.
1.01	8.45	105	.06	.04	.02	164.	1.01	21.15	255	.02	.02	.00	85.
1.01	8.50	106	.06	.05	.02	166.	1.01	21.20	256	.02	.02	.00	85.
1.01	8.55	107	.06	.05	.02	168.	1.01	21.25	257	.02	.02	.00	85.
1.01	9.00	108	.06	.05	.02	170.	1.01	21.30	258	.02	.02	.00	85.
1.01	9.05	109	.06	.05	.02	172.	1.01	21.35	259	.02	.02	.00	85.
1.01	9.10	110	.06	.05	.02	174.	1.01	21.40	260	.02	.02	.00	85.
1.01	9.15	111	.06	.05	.02	176.	1.01	21.45	261	.02	.02	.00	85.
1.01	9.20	112	.06	.05	.02	178.	1.01	21.50	262	.02	.02	.00	85.
1.01	9.25	113	.06	.05	.02	180.	1.01	21.55	263	.02	.02	.00	85.
1.01	9.30	114	.06	.05	.02	181.	1.01	22.00	264	.02	.02	.00	85.
1.01	9.35	115	.06	.05	.02	183.	1.01	22.05	265	.02	.02	.00	85.

1.01	9.40	116	.04	.05	.02	184.	1.01	22.10	266	.02	.02	.00	95.
1.01	9.45	117	.04	.05	.02	186.	1.01	22.15	267	.02	.02	.00	85.
1.01	9.50	118	.06	.05	.02	187.	1.01	22.20	268	.02	.02	.00	85.
1.01	9.55	119	.06	.05	.01	189.	1.01	22.25	269	.02	.02	.00	85.
1.01	10.00	120	.06	.05	.01	190.	1.01	22.30	270	.02	.02	.00	85.
1.01	10.05	121	.06	.05	.01	192.	1.01	22.35	271	.02	.02	.00	85.
1.01	10.10	122	.06	.05	.01	193.	1.01	22.40	272	.02	.02	.00	85.
1.01	10.15	123	.06	.05	.01	194.	1.01	22.45	273	.02	.02	.00	85.
1.01	10.20	124	.06	.05	.01	195.	1.01	22.50	274	.02	.02	.00	85.
1.01	10.25	125	.06	.05	.01	197.	1.01	22.55	275	.02	.02	.00	85.
1.01	10.30	126	.06	.05	.01	198.	1.01	23.00	276	.02	.02	.00	85.
1.01	10.35	127	.06	.05	.01	199.	1.01	23.05	277	.02	.02	.00	85.
1.01	10.40	128	.06	.05	.01	200.	1.01	23.10	278	.02	.02	.00	85.
1.01	10.45	129	.06	.05	.01	201.	1.01	23.15	279	.02	.02	.00	85.
1.01	10.50	130	.06	.05	.01	202.	1.01	23.20	280	.02	.02	.00	85.
1.01	10.55	131	.06	.05	.01	203.	1.01	23.25	281	.02	.02	.00	85.
1.01	11.00	132	.06	.05	.01	204.	1.01	23.30	282	.02	.02	.00	85.
1.01	11.05	133	.06	.05	.01	205.	1.01	23.35	283	.02	.02	.00	85.
1.01	11.10	134	.06	.05	.01	206.	1.01	23.40	284	.02	.02	.00	85.
1.01	11.15	135	.06	.05	.01	207.	1.01	23.45	285	.02	.02	.00	85.
1.01	11.20	136	.06	.05	.01	208.	1.01	23.50	286	.02	.02	.00	85.
1.01	11.25	137	.06	.05	.01	208.	1.01	23.55	287	.02	.02	.00	85.
1.01	11.30	138	.06	.05	.01	209.	1.02	0.00	288	.02	.02	.00	85.
1.01	11.35	139	.06	.05	.01	210.	1.02	.05	289	0.00	0.00	0.00	93.
1.01	11.40	140	.06	.05	.01	211.	1.02	.10	290	0.00	0.00	0.00	80.
1.01	11.45	141	.06	.05	.01	212.	1.02	.15	291	0.00	0.00	0.00	73.
1.01	11.50	142	.06	.05	.01	212.	1.02	.20	292	0.00	0.00	0.00	67.
1.01	11.55	143	.06	.05	.01	213.	1.02	.25	293	0.00	0.00	0.00	61.
1.01	12.00	144	.06	.06	.01	214.	1.02	.30	294	0.00	0.00	0.00	55.
1.01	12.05	145	.22	.19	.03	221.	1.02	.35	295	0.00	0.00	0.00	51.
1.01	12.10	146	.22	.19	.03	243.	1.02	.40	296	0.00	0.00	0.00	46.
1.01	12.15	147	.22	.19	.03	288.	1.02	.45	297	0.00	0.00	0.00	42.
1.01	12.20	148	.22	.19	.03	355.	1.02	.50	298	0.00	0.00	0.00	38.
1.01	12.25	149	.22	.19	.03	431.	1.02	.55	299	0.00	0.00	0.00	35.
1.01	12.30	150	.22	.20	.02	506.	1.02	1.00	300	0.00	0.00	0.00	32.
									SUM	33.67	30.16	3.51	120401.
										(855.)(	766.)(	89.)(	3409.381

********** ********** ********** ********** **********

HYDROGRAPH ROUTING

FLOOD INFLOW ROUTED OVER OLD MINES TAILINGS DAM SPILLWAY

ISTAO	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
LAKE	1	0	0	1	1	1	0	0

ROUTING DATA

OLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTOL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-85.	-1

STAGE	85.00	85.50	86.00	86.50	87.00	87.50	88.00	88.50	89.00	89.20
FLOW	0.00	34.20	136.00	314.20	593.20	1023.00	1742.20	2723.30	3962.10	5867.00

SURFACE AREA=	0.	36.	63.	81.	98.	122.
CAPACITY=	0.	38.	126.	270.	627.	1517.
ELEVATION=	80.	83.	85.	87.	91.	100.

CREL	SPWID	COOW	EXPW	ELEVL	COOL	CAREA	EXPL
85.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COOD	EXPD	DAMWID
87.2	0.0	0.0	0.

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS RATIO 1 .14	RATIO 2 .16	RATIO 3 .40	RATIO 4 .50	RATIO 5 .75	RATIO 6 1.00
HYDROGRAPH AT	INFL	.51	1	585.	669.	1671.	2089.	3134.	4179.
		(1.32)		(16.57)(	18.93)(	47.33)(	59.16)(	88.75)(	118.33)(
ROUTED TO	LAKE	.51	1	146.	182.	704.	975.	1841.	2736.
		(1.32)		(4.14)(	5.16)(	19.94)(	27.61)(	52.12)(	77.48)(

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	85.00	85.00	87.20
STORAGE	126.	126.	296.
OUTFLOW	0.	0.	765.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.14	86.01	0.99	136.	146.	0.00	17.58	0.00
.16	86.18	0.98	138.	182.	0.00	17.42	0.00
.40	87.19	0.99	249.	704.	0.00	15.75	0.00
.50	87.64	.44	296.	975.	1.58	15.58	0.00
.75	88.80	1.60	452.	1841.	15.08	15.33	0.00
1.00	89.81	2.61	574.	2736.	15.75	15.25	0.00

... Add 800 feet to elevations shown for true elevation.

APPENDIX B

INFORMATION SUPPLIED BY OTHERS

(for file only)

ENGINEERING GEOLOGIC REPORT ON GENERAL BARITE MINING TAILINGS POND

Washington County, Mo.

LOCATION: Center Sec. 18, T. 38 N., R. 3 E., Tiff Quadrangle

GEOLOGIC SETTING:

The dam and tailings pond are underlain by Potosi dolomite. Bedrock is exposed at the downstream toe of the dam. Soil primarily of stony red clay. A surface soil of yellow brown silt loam some 3 feet covers the flatter hillslopes.

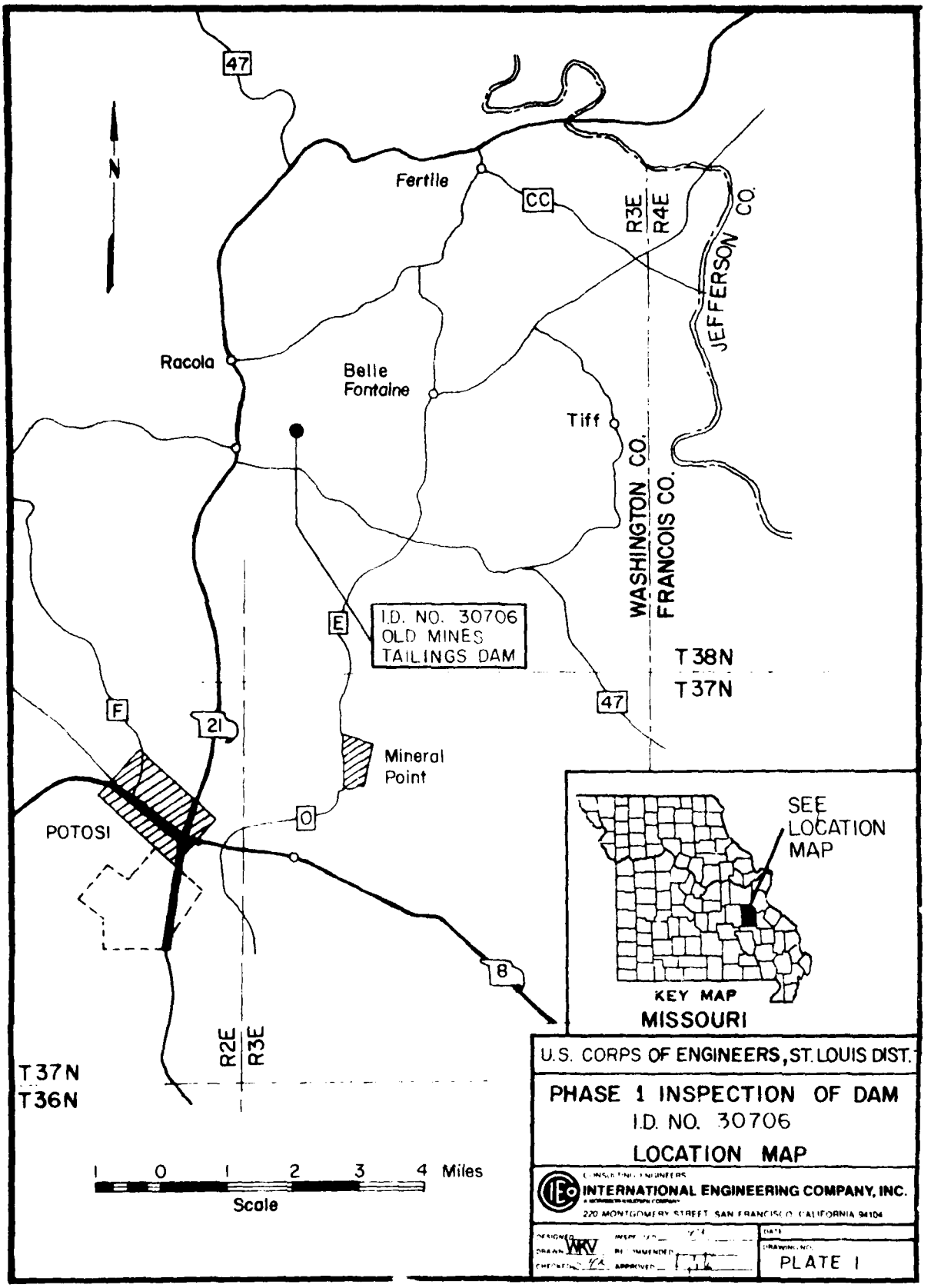
The dam is approximately 60 feet in height with a crest width of 45 feet. Freeboard is 3 to 5 feet. The dam has evidence of substantial stability. Very little leakage is present on the downstream toe. Here Potosi bedrock is exposed and appears fresh and unweathered.

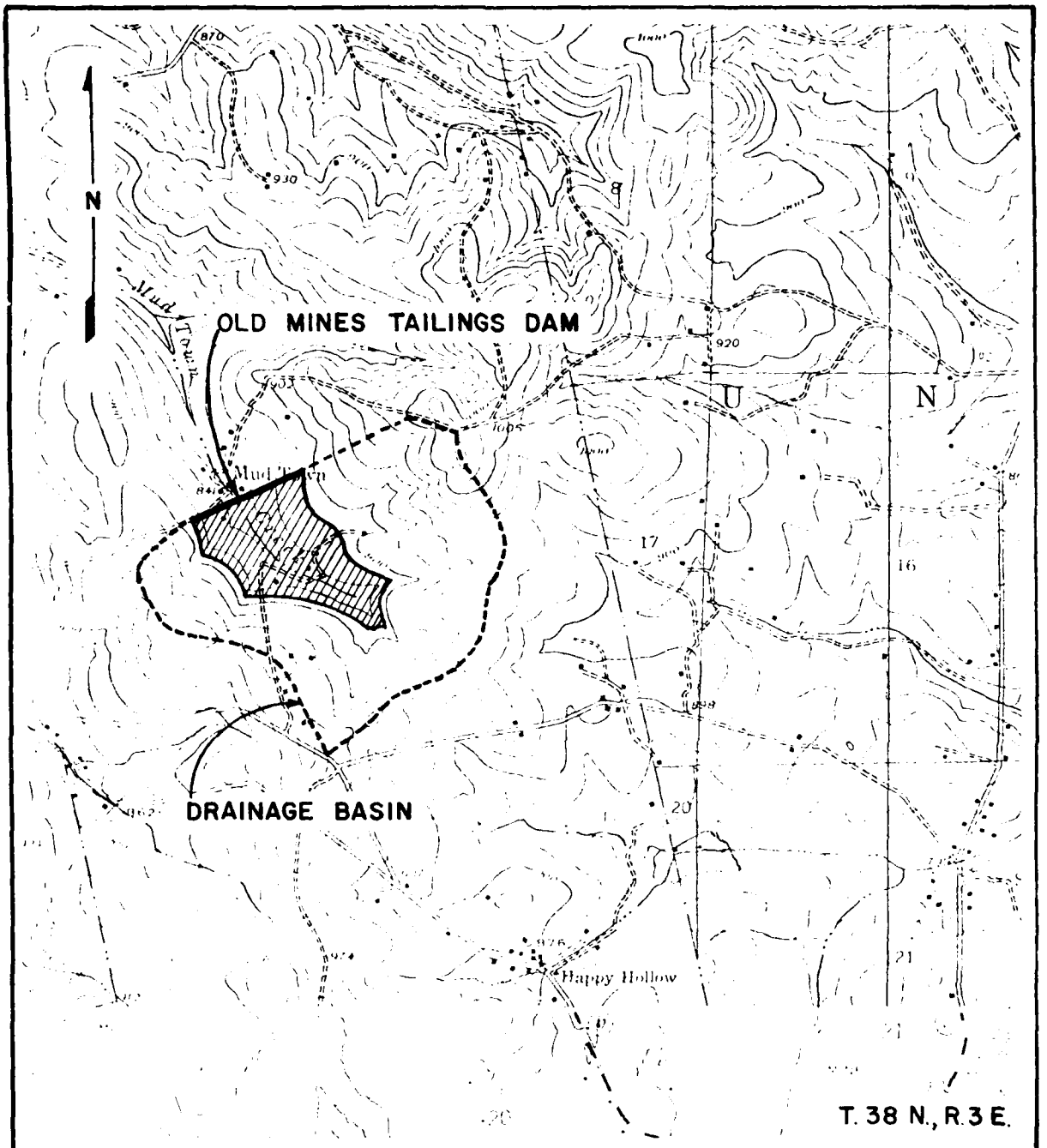
Slopes of the dam average 1 and 1/3rd to 1. Bouldery clay has been dumped onto the back slope. This material has slide from the slope because of the extreme steepness.

RECOMMENDATIONS:

The important aspect is that all material placed on the back slope should not be dumped from the crest. Rather it should be placed at the downstream toe and compacted at that location. Inadequate temporary detention structures across the spillway have been constructed to detain water for milling purposes. However, these should be removed as recommended by MESA to the vice president, Mr. Charles Faulkner.

Dr. J. Hadley Williams, Chief
Applied Engineering & Urban Geology
Missouri Geological Survey
September 23, 1975


47
N
Fertile
CC
R3E
R4E
JEFFERSON CO.
Racola
Belle
Fontaine
Tiff
WASHINGTON CO.
FRANCOIS CO.
I.D. NO. 30706
OLD MINES
TAILINGS DAM
E
T38N
T37N
47
F
21
Mineral
Point
O
POTOSI
8
R2E
R3E
T37N
T36N
1 0 1 2 3 4 Miles
Scale
SEE
LOCATION
MAP
KEY MAP
MISSOURI
U.S. CORPS OF ENGINEERS, ST. LOUIS DIST.
PHASE 1 INSPECTION OF DAM
I.D. NO. 30706
LOCATION MAP
INTERNATIONAL ENGINEERING COMPANY, INC.
220 MONTGOMERY STREET, SAN FRANCISCO, CALIFORNIA 94104
WRV
PLATE 1

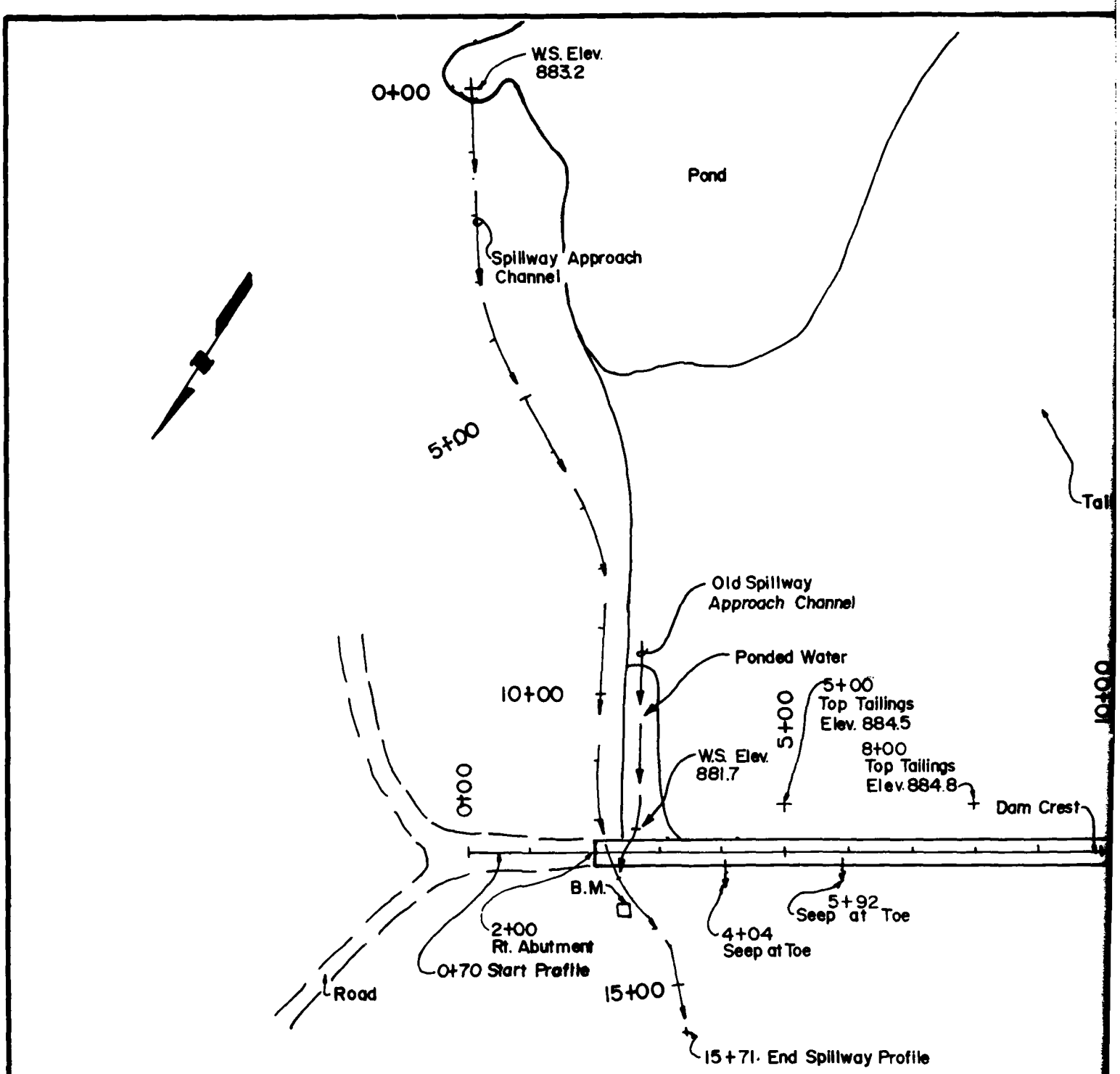


U.S. CORPS OF ENGINEERS, ST. LOUIS DIST

PHASE I INSPECTION OF DAMS
I.D. NO. 30706
VICINITY TOPOGRAPHY

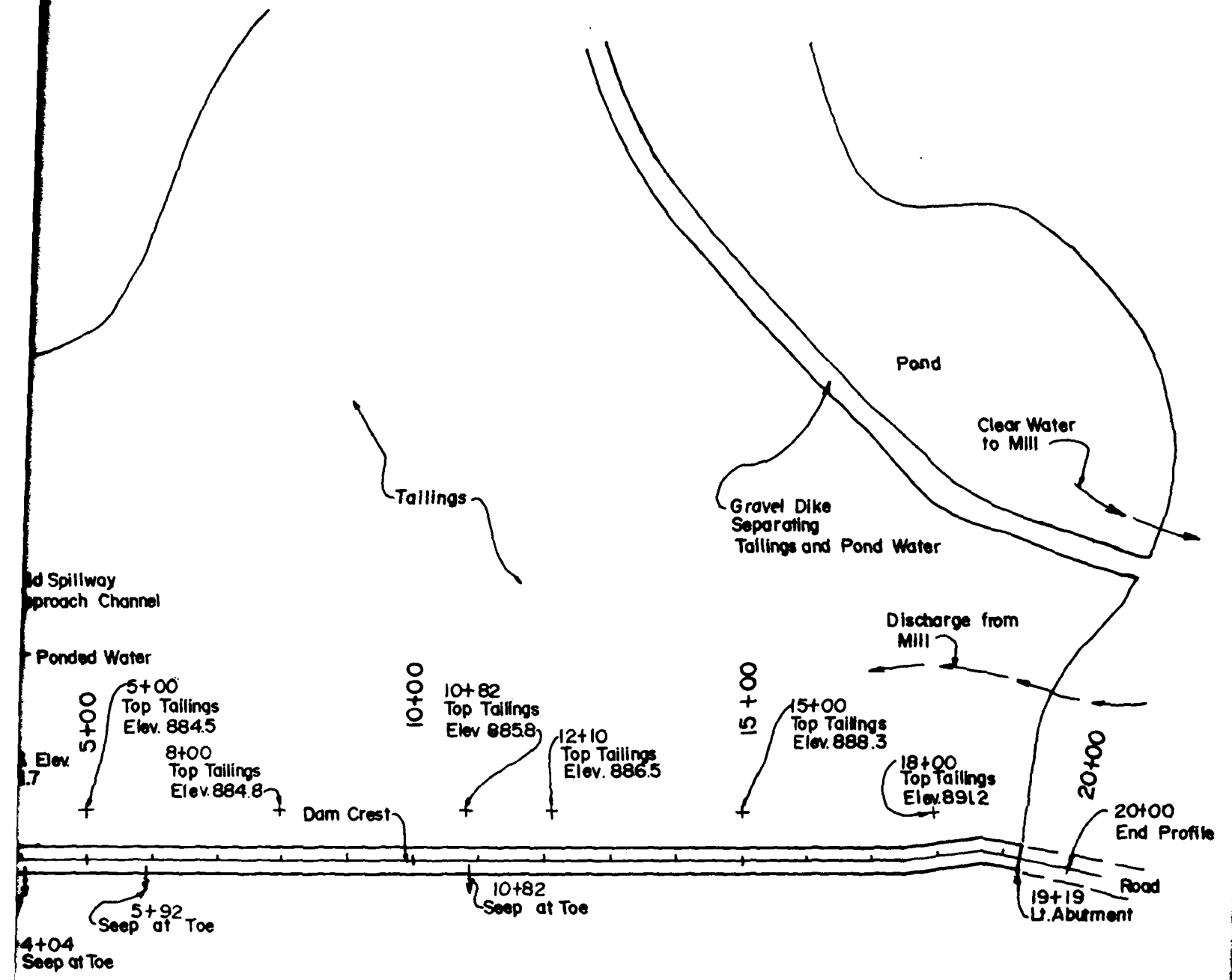
INTERNATIONAL ENGINEERING COMPANY, INC.

PLATE 2



BENCH MARK: RR. Spike in S.E. Side of 10" Oak Tree 90' Rt of Sta. 2+49
Elev. 890.92

Date of Survey 9/11/79



+71· End Spillway Profile

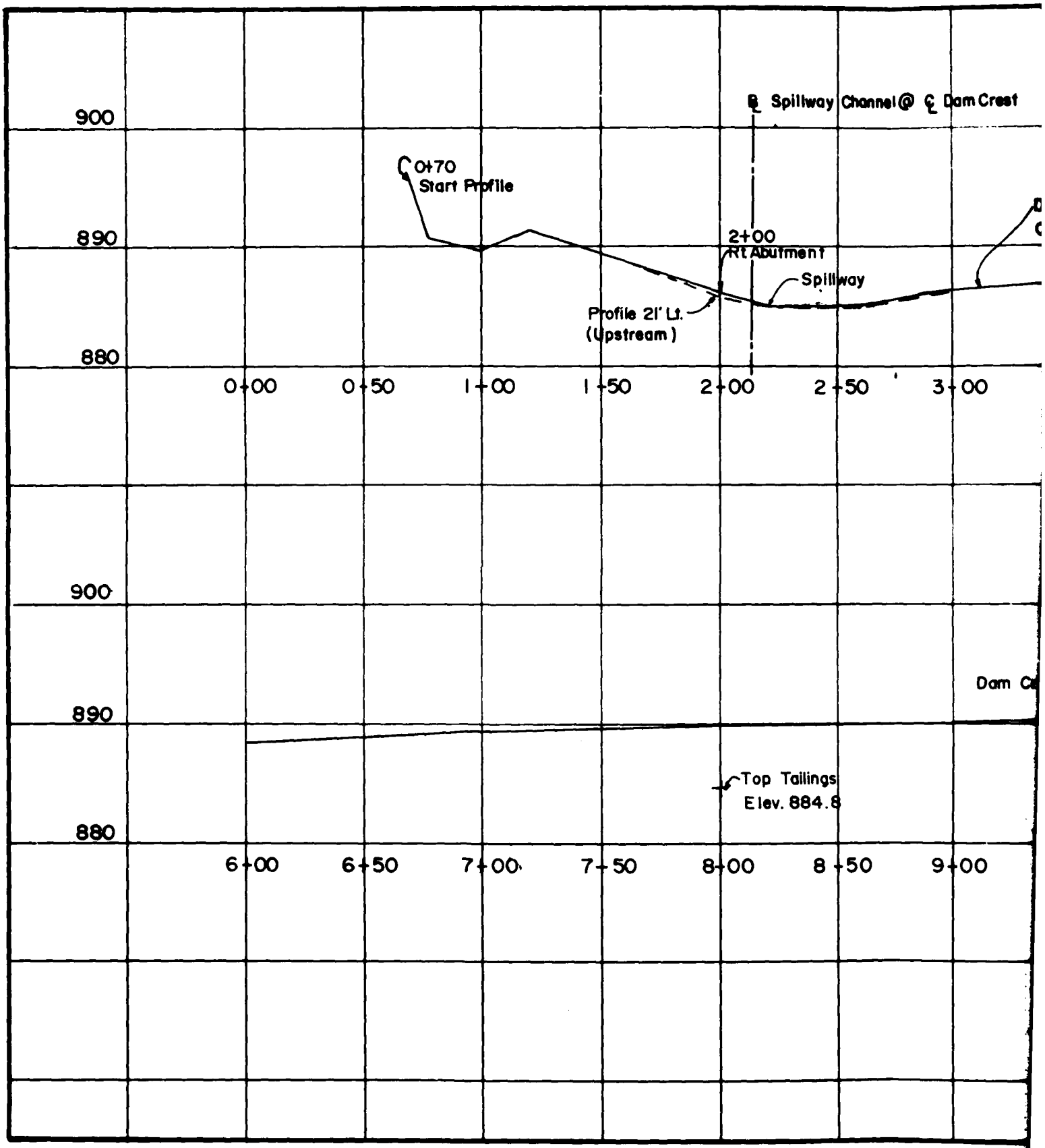
DAM I.D. NO. 30706
OLD MINES TAILINGS DAM

PLAN

SCALE IN FEET

200 100 0 200

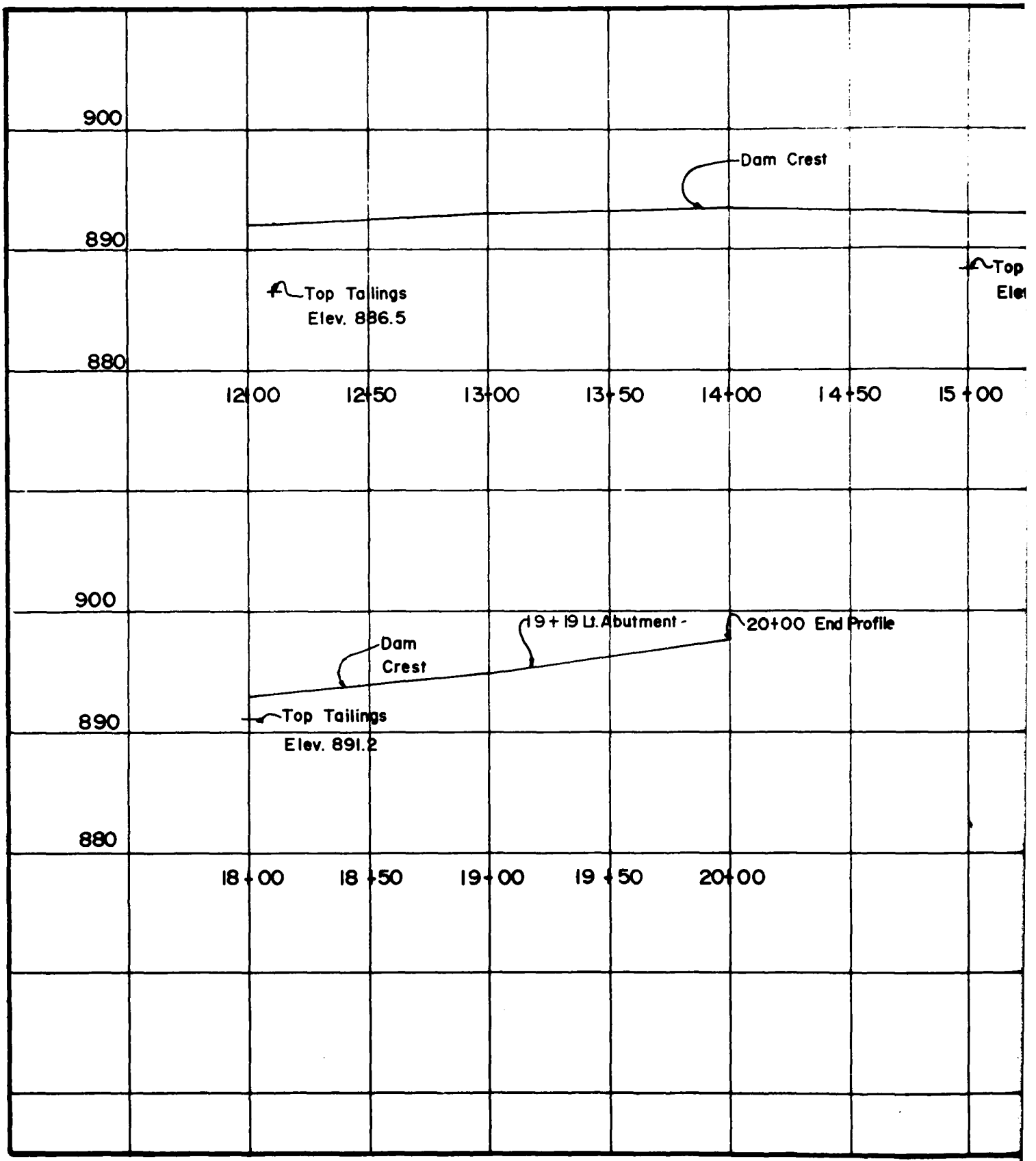
PLATE 3

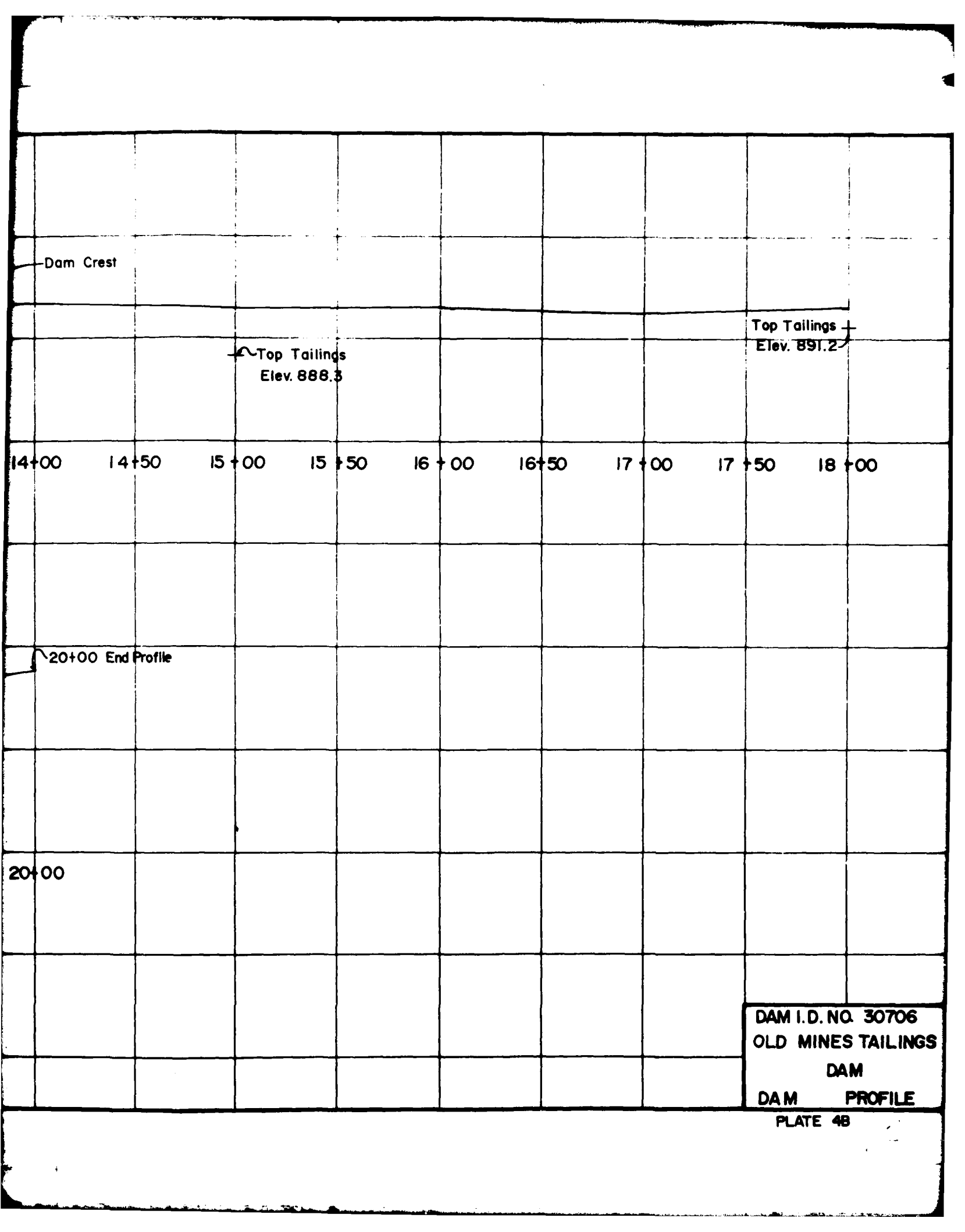

900
890
880
℄ Spillway Channel @ ℄ Dam Crest
0+70
Start Profile
2+00
Rt Abutment
Spillway
Profile 21' Lt.
(Upstream)
0+00
0+50
1+00
1+50
2+00
2+50
3+00
900
890
Dam C
Top Tailings
Elev. 884.8
880
6+00
6+50
7+00
7+50
8+00
8+50
9+00

DAM I.D. NO. 30706
OLD MINES TAILINGS DAM
DAM PROFILE

PLATE 4A

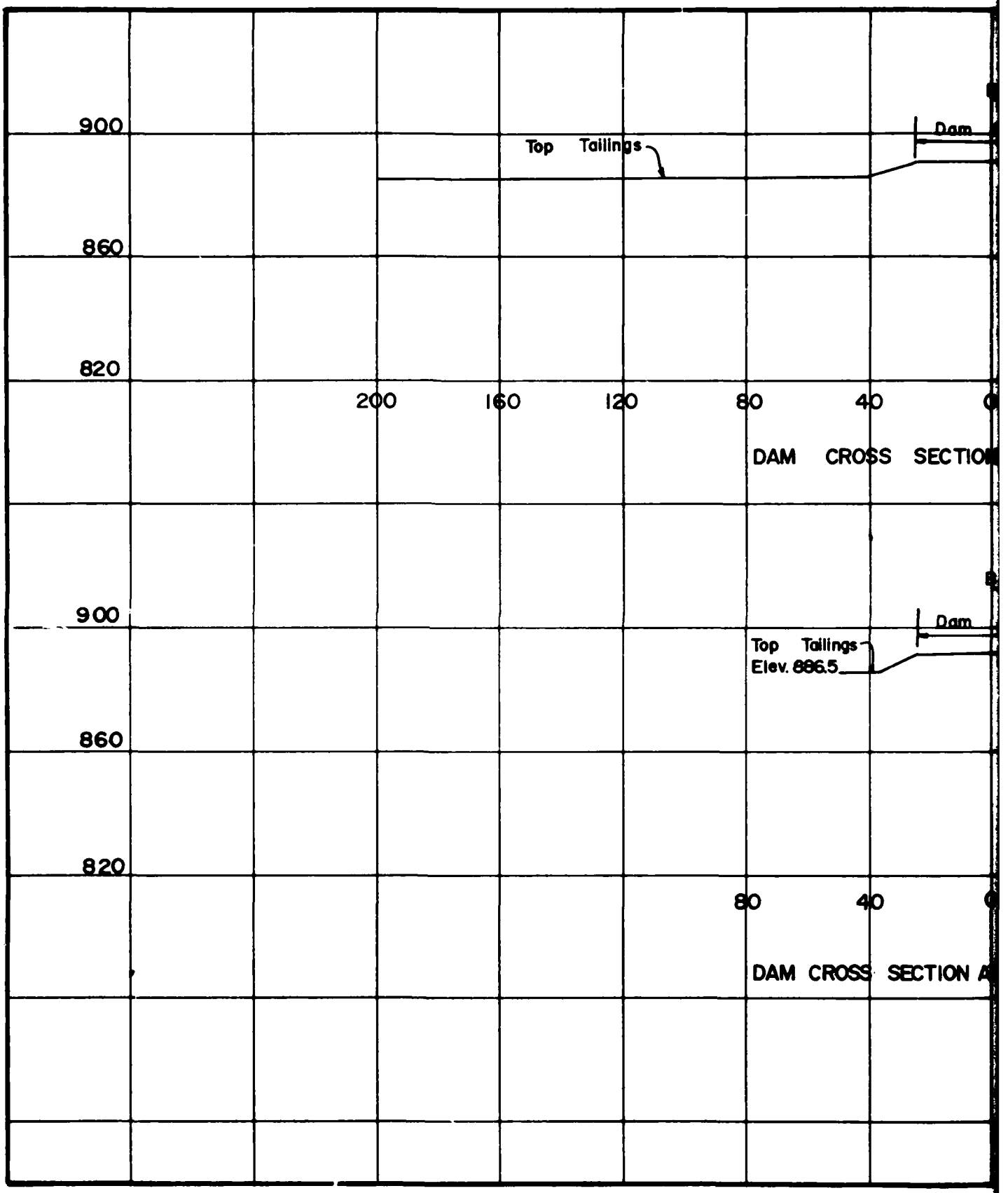
2

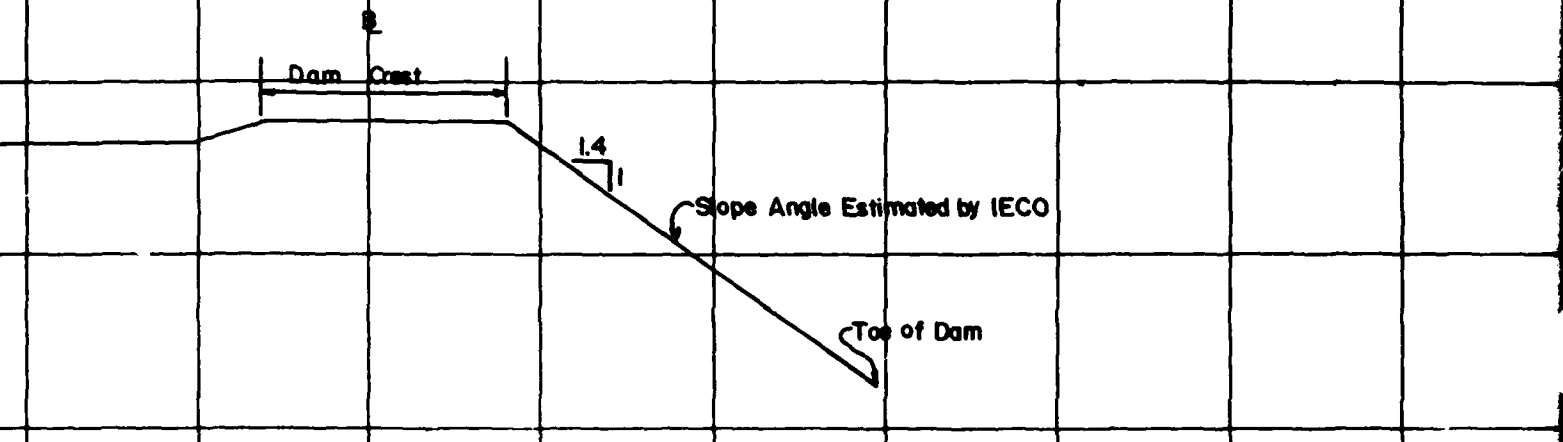

900
890
880
Dam Crest
Top Tailings
Elev. 886.5
Top
Ele
12+00
12+50
13+00
13+50
14+00
14+50
15+00
900
890
880
19+19 Lt. Abutment
20+00 End Profile
Dam
Crest
Top Tailings
Elev. 891.2
18+00
18+50
19+00
19+50
20+00



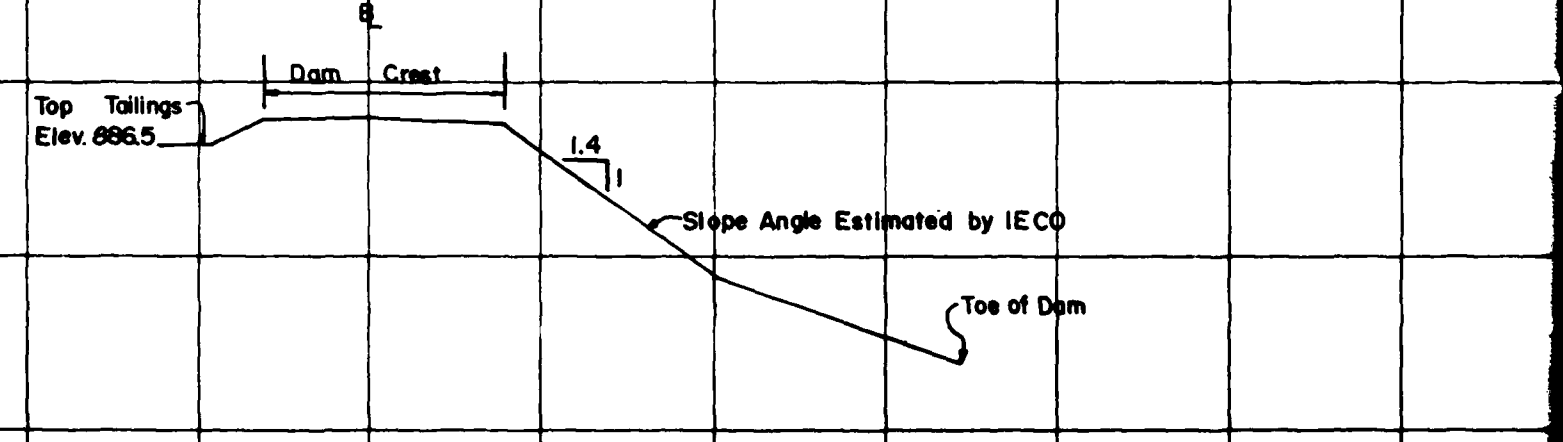
DAM I.D. NO. 30706
OLD MINES TAILINGS
DAM
DAM PROFILE

PLATE 4B


900
860
820
Top Tailings
Dam
200
160
120
80
40
0
DAM CROSS SECTION
900
860
820
Top Tailings
Elev. 886.5
Dam
80
40
0
DAM CROSS SECTION A

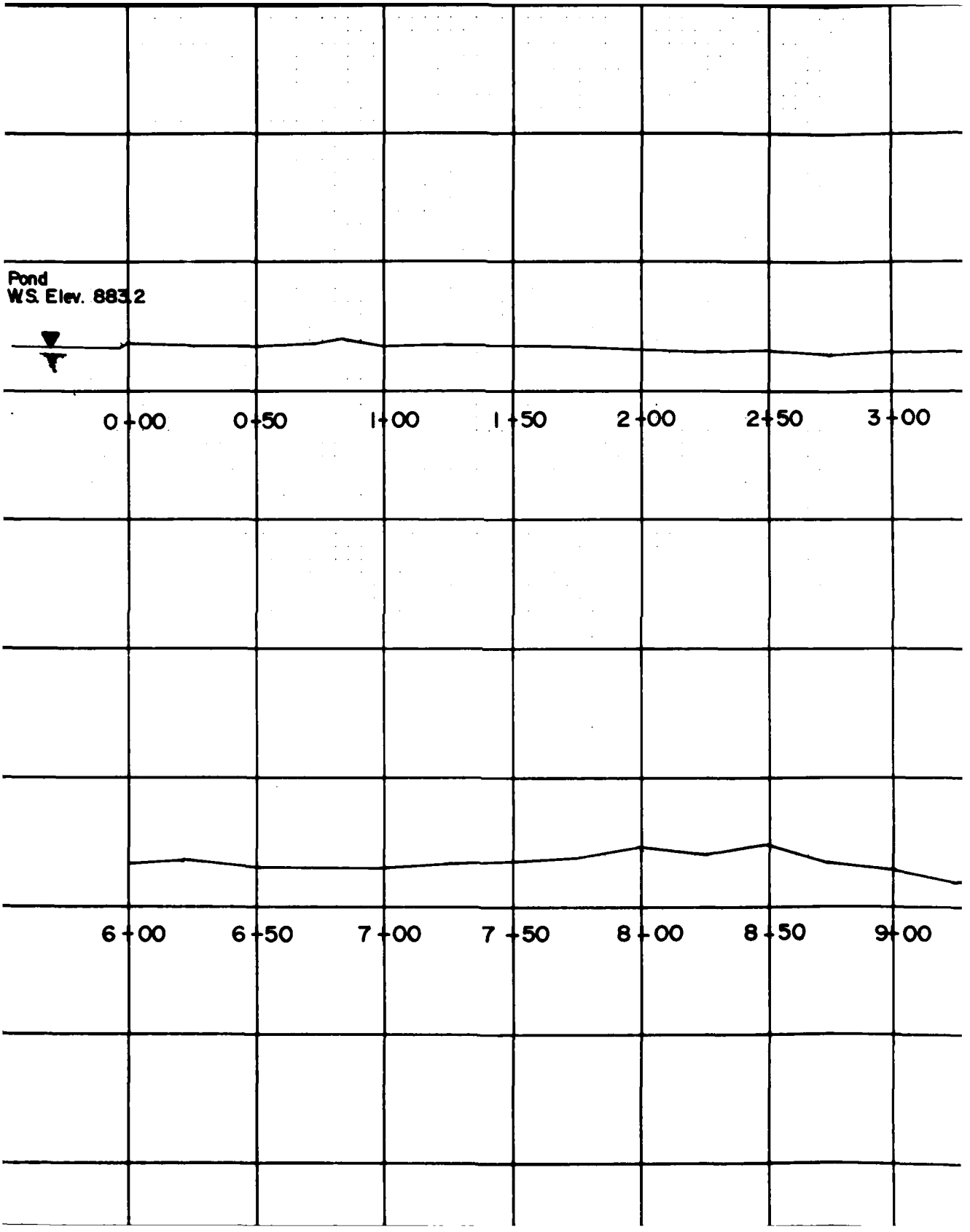


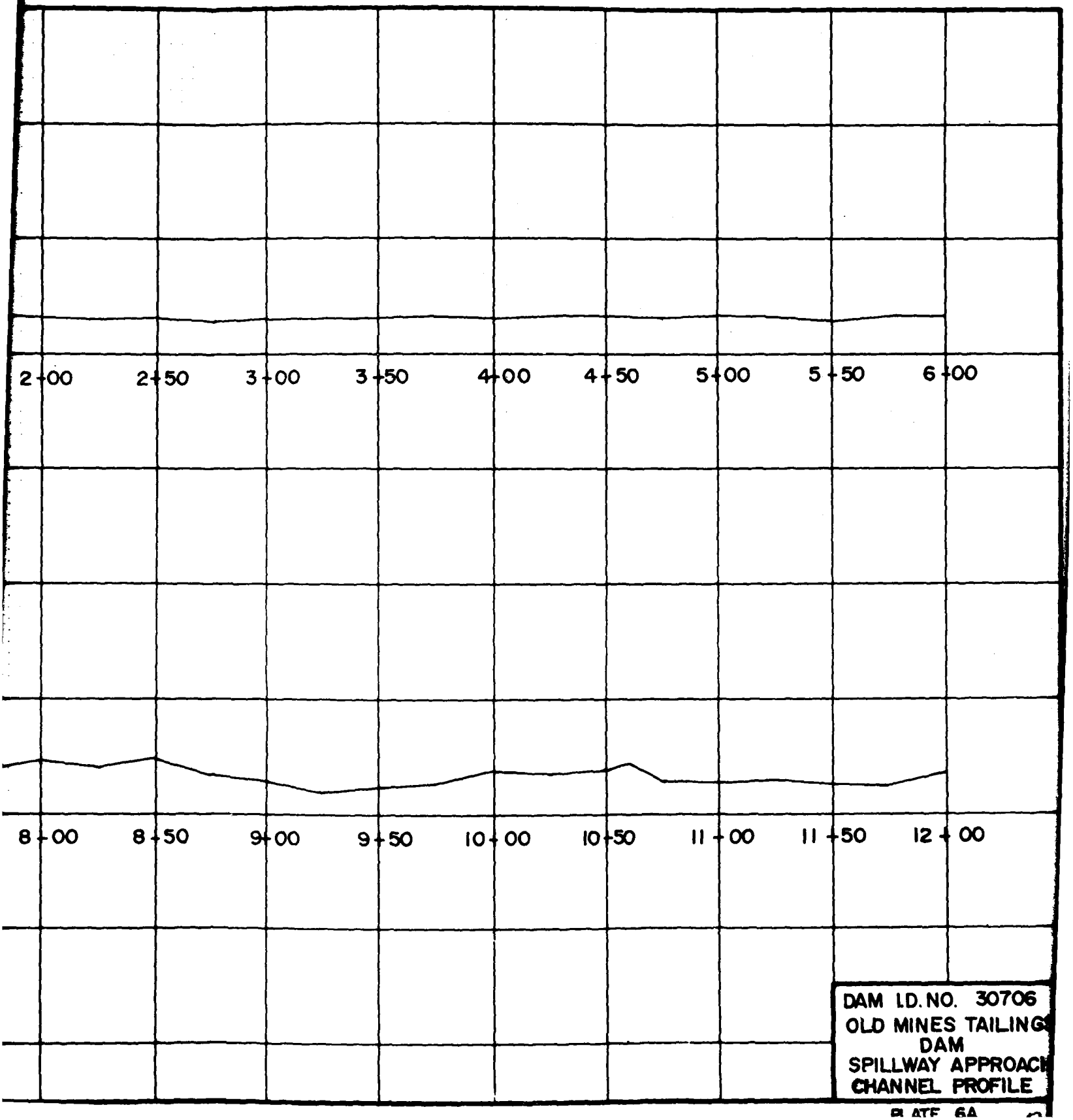
DAM CROSS SECTION AT STA. 10+82



DAM CROSS SECTION AT STA. 12+10

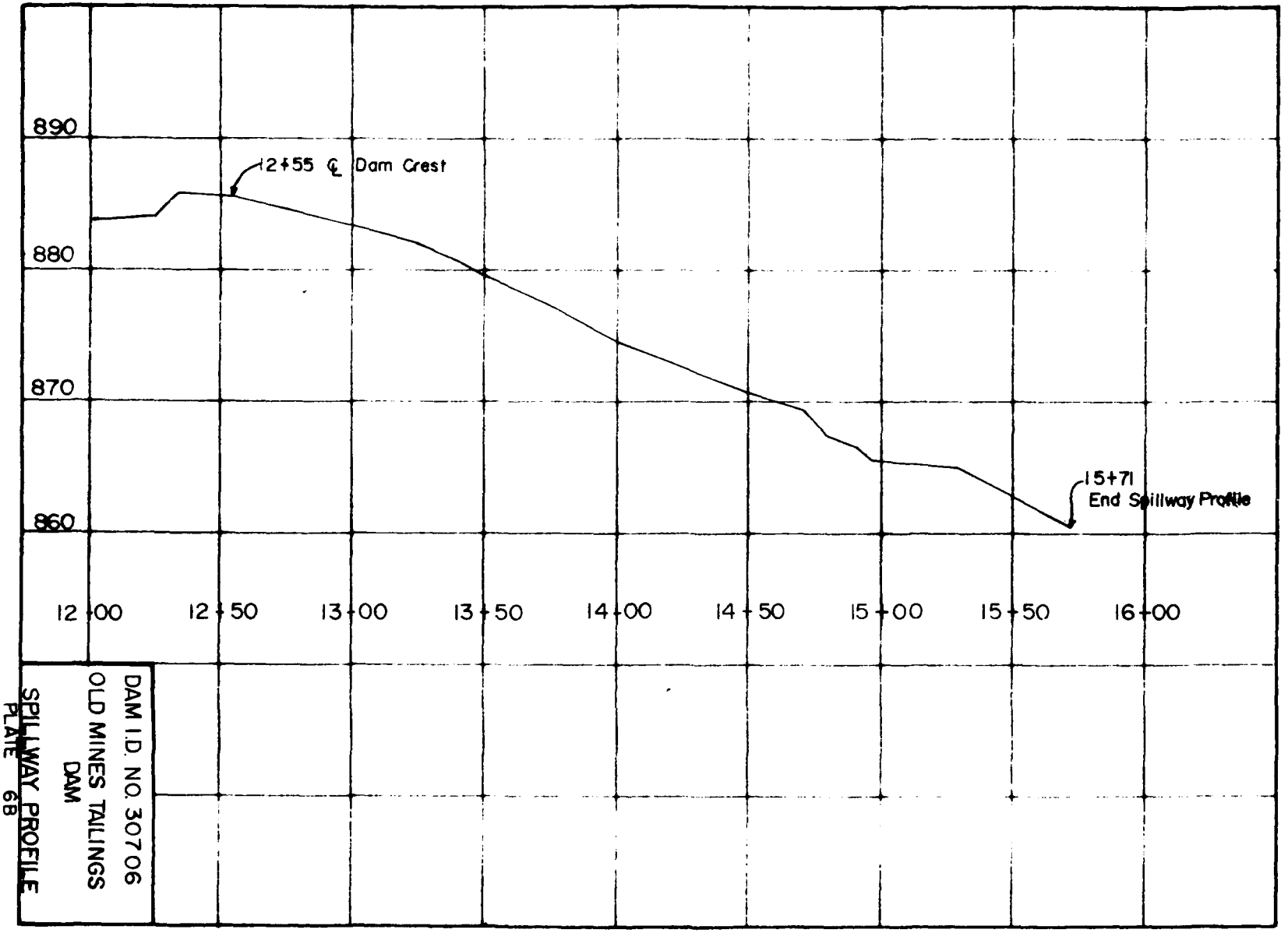
DAM I.D. NO. 30706
OLD MINES TAILING
DAM
DAM CROSS SECTIO


Pond
W.S. Elev. 883.2
0+00
0+50
1+00
1+50
2+00
2+50
3+00
6+00
6+50
7+00
7+50
8+00
8+50
9+00

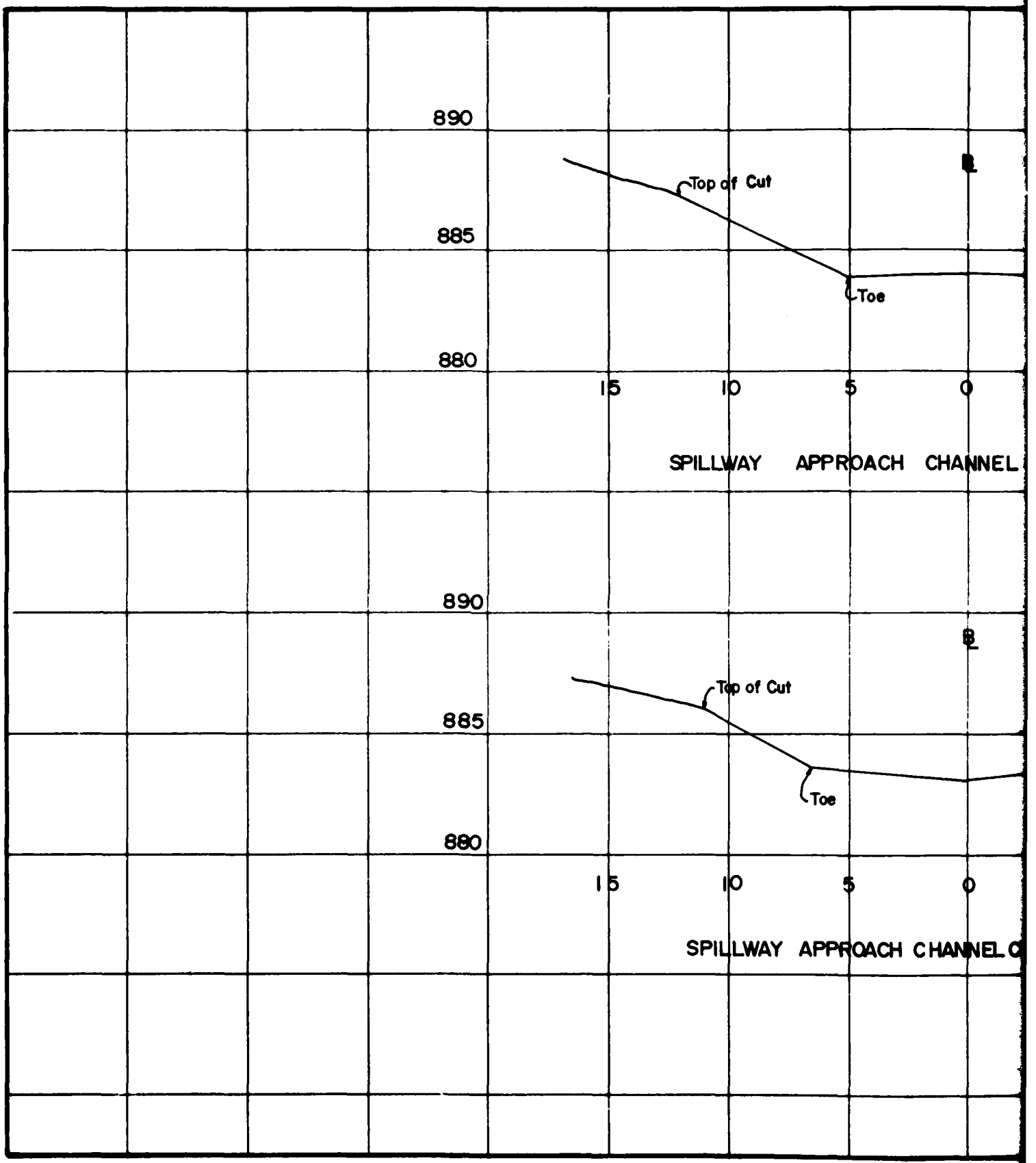


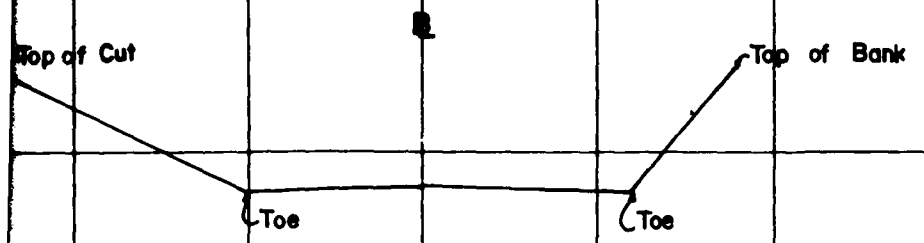
DAM I.D.NO. 30706
OLD MINES TAILINGS
DAM
SPILLWAY APPROACH
CHANNEL PROFILE

PLATE 6A

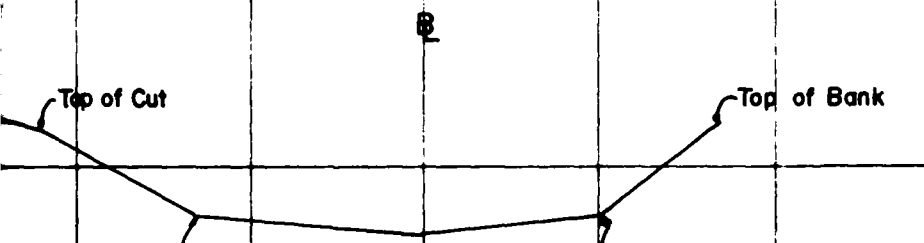


DAM I.D. NO. 30706
OLD MINES TAILINGS
DAM
SPILLWAY PROFILE
PLATE 6B


890
885
880
Top of Cut
Toe
15
10
5
0
SPILLWAY APPROACH CHANNEL
890
885
880
Top of Cut
Toe
15
10
5
0
SPILLWAY APPROACH CHANNEL

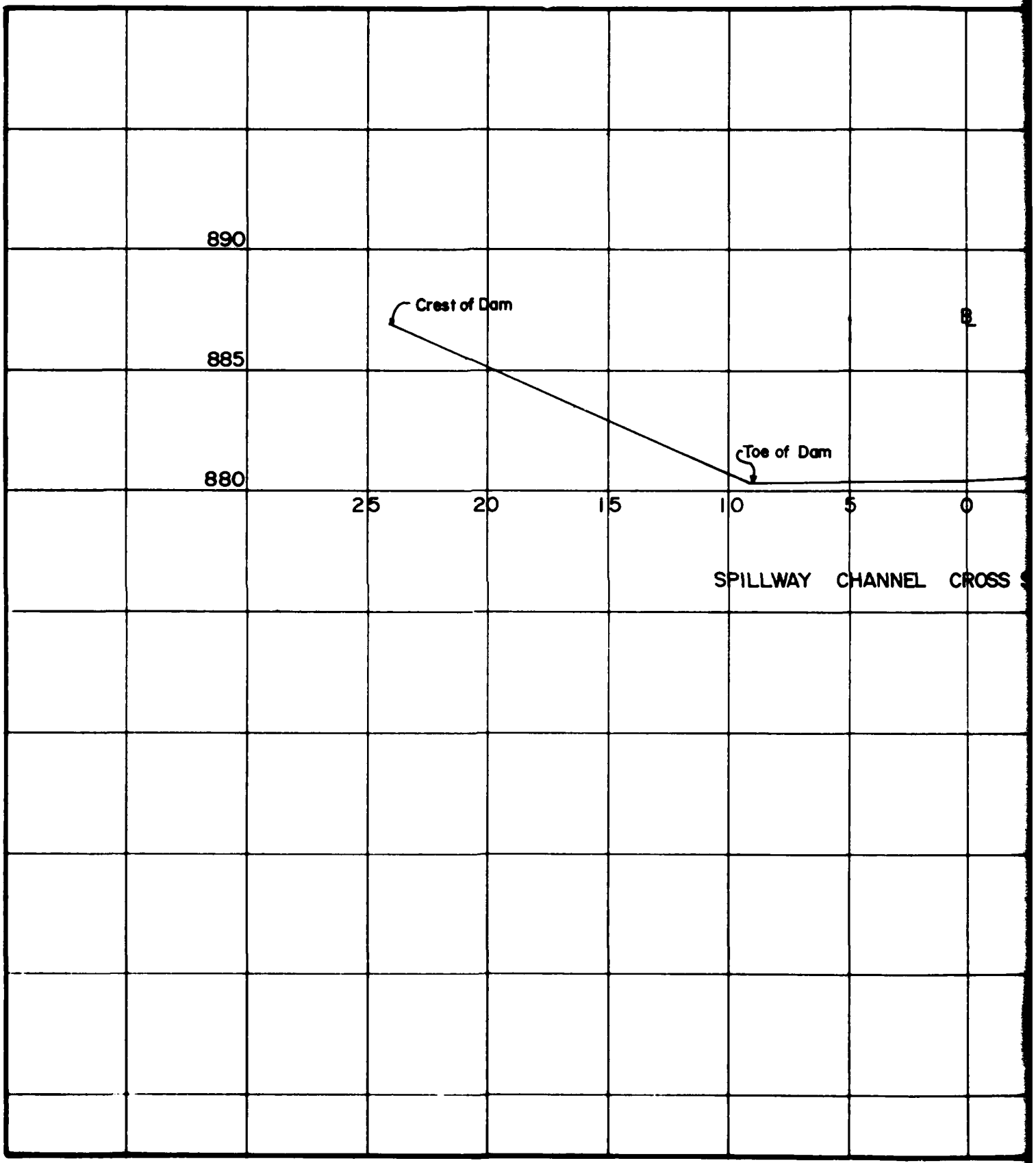


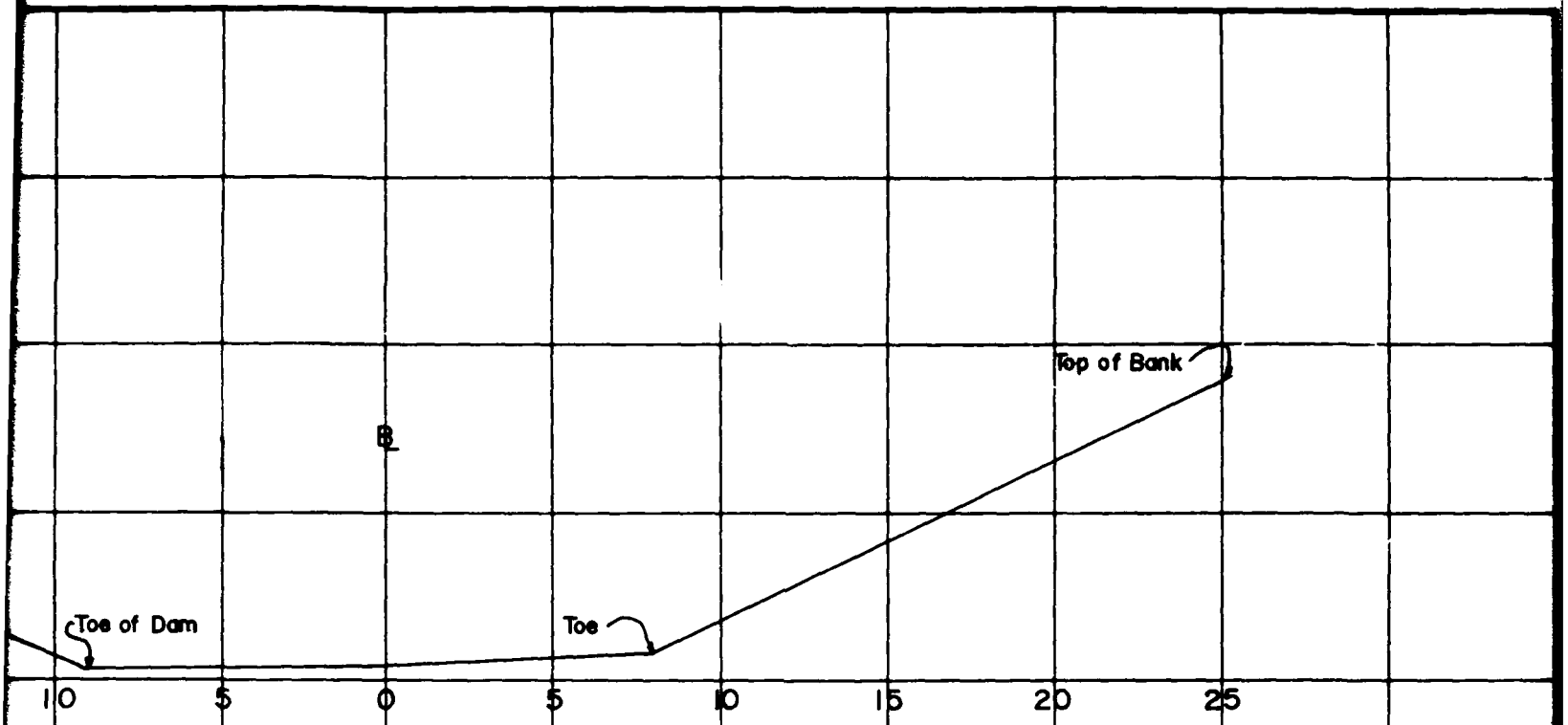
SPILLWAY APPROACH CHANNEL CROSS SECTION AT STA. 0+85



SPILLWAY APPROACH CHANNEL CROSS SECTION AT STA. 3+34

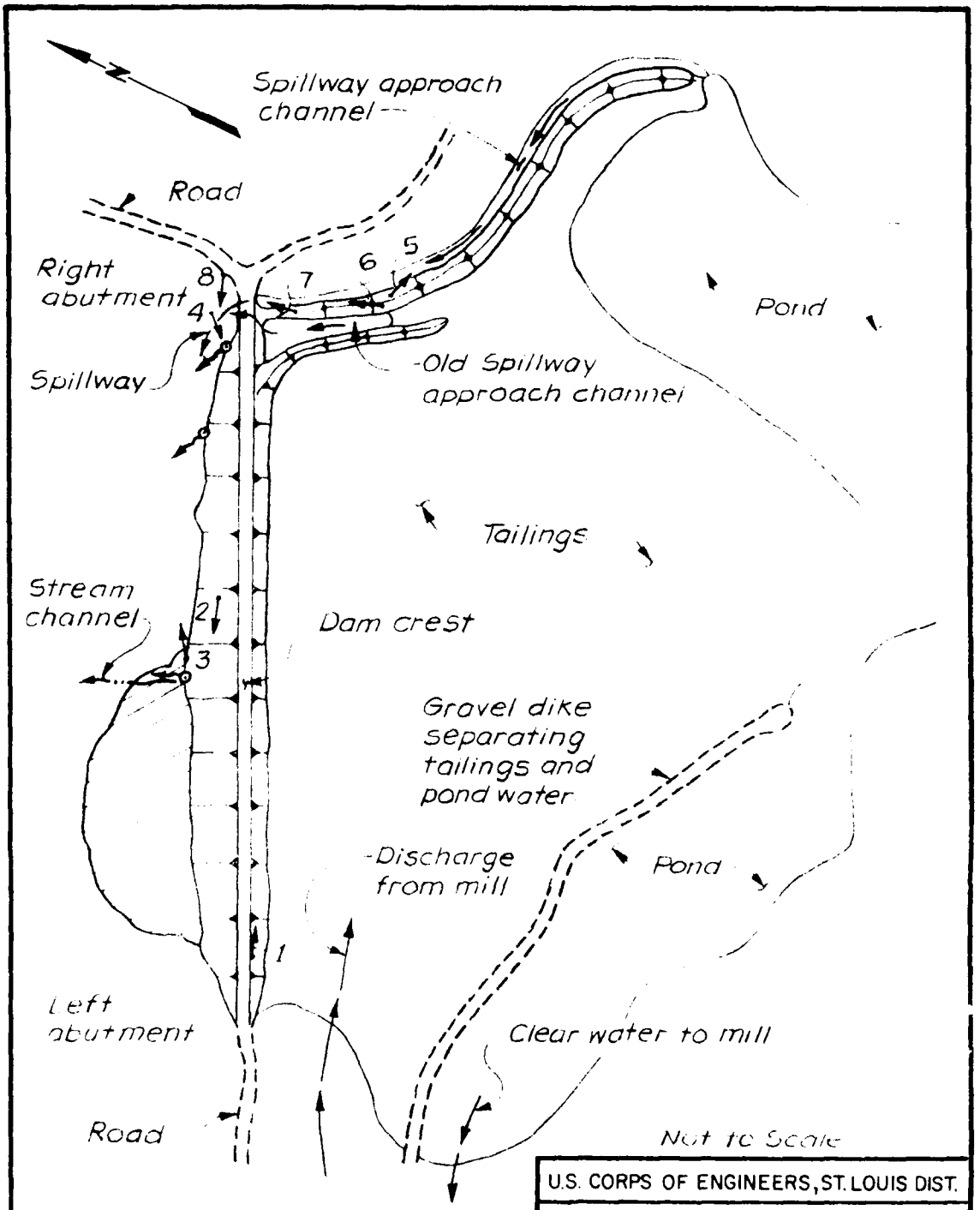
DAM I.D.NO. 30706
OLD MINES TAILINGS DAM
SPILLWAY APPROACH CHANNEL
CROSS SECTIONS
PLATE 7


890
885
880
Crest of Dam
Toe of Dam
℄
25
20
15
10
5
0
SPILLWAY CHANNEL CROSS



SPILLWAY CHANNEL CROSS SECTION AT STA 13+42

DAM I.D. NO. 30706
OLD MINES TAILINGS DAM
SPILLWAY CHANNEL CROSS SECTION
PLATE 8



U.S. CORPS OF ENGINEERS, ST. LOUIS DIST.

PHASE I INSPECTION OF DAMS
I.D. NO. 30706
PHOTOGRAPH LOCATION MAP

CONSULTING ENGINEERS
INTERNATIONAL ENGINEERING COMPANY, INC.
A MORRISON-KNUDSEN COMPANY
180 HOWARD STREET, SAN FRANCISCO, CALIFORNIA 94105

DESIGNED ____ INSPECTED SMK
DRAWN RYS RECOMMENDED ____
CHECKED SMK APPROVED RJC
DATE

DRAWING NO.
PLATE 9

PHOTOGRAPH RECORD

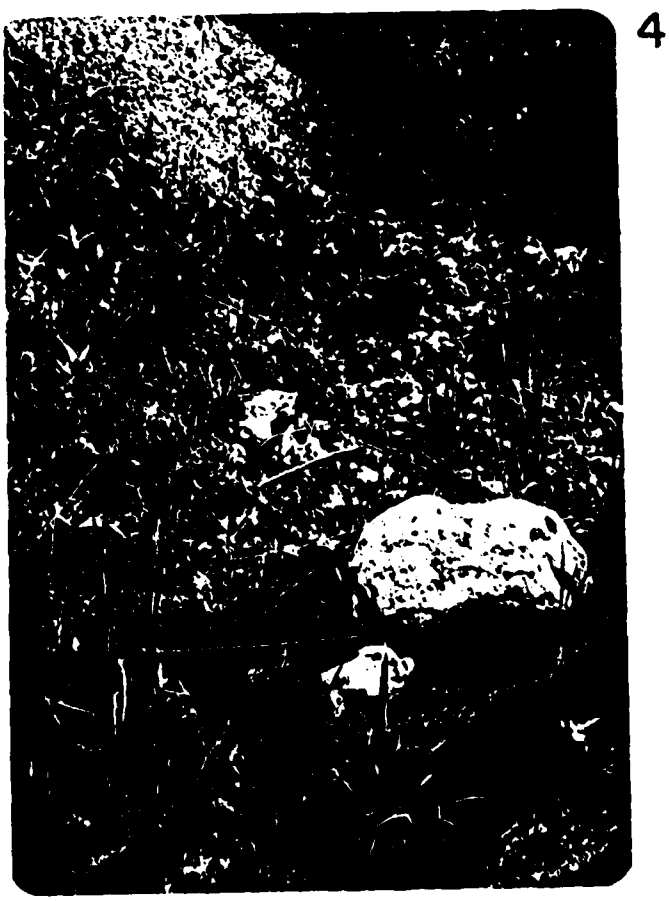
OLD MINES TAILINGS DAM - I. D. NO. 30706

Photo No.	Description
1	View toward right abutment showing upstream face and crest of dam and impounded barite tailings.
2	Downstream face of dam showing buldge in lower half of dam at Station 12+10.
3	Typical seepage, and resulting ponded water and marshy condition at toe of dam.
4	Seep at toe of dam at Station 4+04.
5	View upstream in spillway approach channel.
6	View of spillway approach channel toward dam crest at the right abutment. The old spillway approach channel containing water is visible at the left of the photograph.
7	End of spillway approach channel at right abutment and depression in dam crest haul road over which spillway discharge would pass.
8	Freshly cleared, shallow dowstream spillway channel adjacent to dam toe which terminates on the right abutment hillside.

1

2

3



4

5

6

7

8


DAT
FILM